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# HOW TO FIND FACTORY COSTS

*By*

C. BERTRAND THOMPSON



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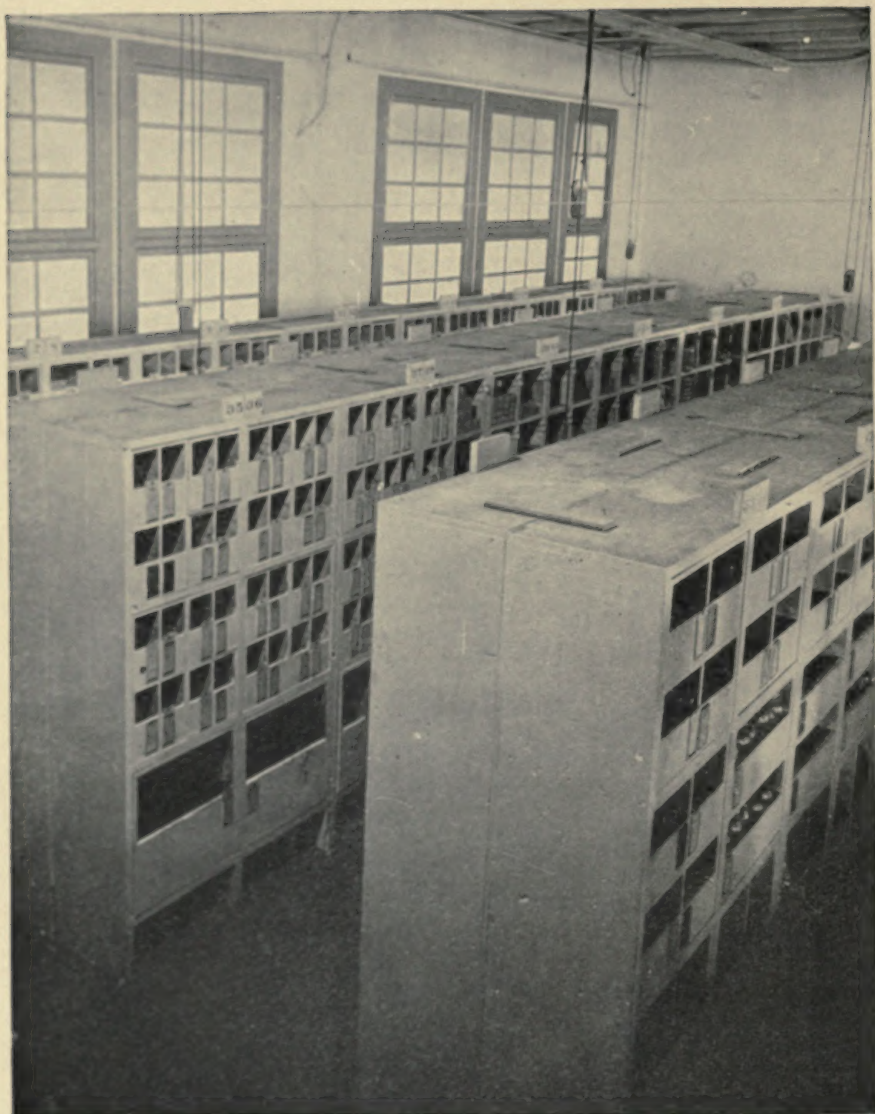
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#### A WELL-PLANNED STOREROOM

*From such a storeroom as this the orders for stock are filled at one successful concern's plant. The racks are numbered to make rapid reference to their contents possible and the double compartments containing small articles are removable so as to facilitate replenishment. Emptying one side of a double compartment automatically signals the need of replenishment*



# HOW TO FIND FACTORY COSTS

ILLUSTRATED WITH FIFTY-ONE  
CHARTS, SEVEN DIAGRAMS  
AND ONE TABLE

By

C. BERTRAND THOMPSON  
INDUSTRIAL CONSULTANT



A. W. SHAW COMPANY

CHICAGO      NEW YORK  
LONDON

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## HOW TO GET THE GREATEST VALUE FROM THIS BOOK

The Federal Trade Commission has called attention to the fact that less than 20 per cent of the business concerns in this country have a cost system, and that a large proportion of the many failures recorded every year are due to the absence of an accurate knowledge of what it costs to manufacture and sell. The Commission is urging every business man to take this first step in the development of that primary effectiveness by means of which this country can alone be brought to an appropriate degree of industrial preparedness.

Realizing that the very large majority of our industrial concerns consists of small plants unable to afford the kind of expert assistance which the larger concerns have drawn on for the development of their cost systems, the publishers of **FACTORY** and **SYSTEM** have from time to time presented articles showing how simple cost systems have been and may be developed. These articles have usually shown applications to special lines of business, and, on account of this fact and the limitations of space, they have not individually been able to handle the subject in comprehensive detail.

In preparing "How to Find Factory Costs" the services of a competent expert have therefore been enlisted to outline briefly and clearly the elements of a good cost system, in such a way that it can be understood and applied by the average manager and the average accountant of the average small plant, without in the least sacrificing that degree of thoroughness and accuracy vital to the success of any cost system. The book is planned to be broad enough to apply to all kinds of

industries. It is intended to be detailed enough to be useful to the accountant, and at the same time to include the relation of cost statistics to the entire effectiveness of operation, so as to be most useful to the factory head.

The author, C. Bertrand Thompson, was selected on account of his experience in the development of cost and efficiency systems in a wide variety of industries, including machine shops, electrical specialties, shoe factories, book binderies, printing plants, and box factories. In addition to this experience, his record as a teacher of factory management at Harvard University, and as a writer on this and other subjects for *FACTORY*, *SYSTEM*, and other magazines, proves him capable of conveying his practical knowledge to others in a form both instructive and interesting.

In accordance with his authorization to use any articles in *FACTORY* and *SYSTEM* (not already reprinted) which might be desirable, he has added a few of these to this book, besides a chapter written by F. B. Cherrington, a certified public accountant of Boston, who has been associated with Mr. Thompson in professional work. All these contributions have been thoroughly edited by Mr. Thompson, and the entire work has therefore been under his supervision.

"How to Find Factory Costs" is written for the manager—the executive—as well as for the accountant. It aims to show you what your costs ought to tell, as well as how to devise a cost system for your plant. It may be used as a check on the system you are now using, no matter what line of business you are in, or as a guide to the development of a new system.

You may find a suggestion about how you can use "How to Find Factory Costs" to best advantage quite helpful. First, carefully read the book *through*. When this reading is completed, you will find it useful to read every page a second time.

Second, decide what type of costs you want to get. This decision will depend on the type of plant you operate and you will select either assembling, continuous or tonnage costs.



Third, decide whether you want your costs by yards or tons, or by lines, or by departments, or by operations, or by jobs, or by some combination of these various plans.

This book is written in a general way for all types of factories and it is only by making these decisions that you can know surely what parts of it to apply to your own needs. The first steps for which to make practical provision are your direct labor and material costs.

Fourth, decide which method of time-keeping you will use; whether a single card for all jobs, to be filled in by the workman, or a separate card for each job, to be filled in by the workman, the foreman, or a planning department.

Fifth, get some kind of perpetual inventory started, whether it be the most simple or the most complex, or something in between.

Sixth, devise a form of requisition on which materials will be issued and charged, and make and enforce a rule that no materials will be issued to anyone without a requisition. These steps will give you control of your direct labor and material costs.

Seventh, study carefully the various items that enter into indirect costs, and see to it that you have listed *all* that exist in your plant, *with no exceptions whatsoever*.

Eighth, weigh the advantages and disadvantages for your purposes of the various methods of distribution described, and decide which one or which combination you will use. Bear in mind that it is usually advisable to use different methods in different departments, when these departments are not uniform in respect to make-up and methods.

Ninth, whichever method or methods of distribution you decide on, work them up in detail on the forms suggested, and test them out for awhile. Then make such modifications as experience shows to be desirable. While this is the most difficult part of your job, and the one on which you should call in expert help if anywhere, it is by all odds the most important and the one which it will cost you most heavily to neglect.

Tenth, use the forms in this book largely as *suggestions*. Draw up your first forms with the definite understanding that they are tentative and experimental only. Don't have them printed in large quantities; if you have a blue-print machine, run off a limited number on it first, and use these until you are sure your forms are in exactly the shape you want.

Eleventh, and finally, remember that no form has any value unless it is properly and intelligently used. Train your clerks in the meaning and nature of the philosophy of cost accounts, and see that they really *understand* what they are doing. Every form should be accompanied with definite written instructions covering its origin, use, and disposition. Clerks must be thoroughly and patiently trained, and frequently checked to see that they are doing what they are supposed to do.



# I

## WHAT A GOOD COST SYSTEM MEANS TO YOU

Do you realize that your cost system may mean the life or death of your business?

Every receiver in bankruptcy can tell you stories about facts discovered in business autopsies, which were responsible for failures and which could have been discovered before it was too late through the aid of good cost systems. Every receivership, in other words, means that many a business could easily have been saved by accurate cost accounting.

This was the case with a certain garment factory which made four lines of garments, including undermuslins, brassieres, night-robcs and children's suits. Costs were not departmentalized. Styles changed, petticoats and slips became losing propositions, and profits began to dwindle. Frantic efforts were made to stimulate sales, but the campaign was unintelligent because it worked in the dark. The autopsy showed that the brassieres and children's goods were making money, while the other lines were losing heavily. An adequate cost system would have brought these facts out in time to be useful.

Another plant had its costs departmentalized, but under a method of distribution of general expense that loaded certain departments with much more than their just shares, and correspondingly relieved other departments of their just proportions of the burden. The result was entirely misleading,

for it showed high profits from certain lines, and heavy losses from others. The loss shown on one line was so heavy that the firm decided to discontinue it, although it was a good one for advertising purposes, and ought to have been a money-maker. When an analysis and correction of the cost system showed the source of the error, an apparently large loss turned out to be a small one, and the line was retained. There is every prospect that it will be quite profitable.

A COST SYSTEM WOULD HAVE SAVED THIS COMPANY \$32,000  
ON JUST ONE ITEM ALONE

A company manufacturing electrical specialties got out one which it sold to the distributor for \$100, to be retailed at \$150. Four thousand of them were sold before an investigation brought out the fact that it was costing \$108 to make each of them. The \$100 price had been set on a guess. That particular guess cost \$32,000 before it was corrected by an accurate knowledge of costs. This loss would have paid several times over the cost of about the most elaborate cost system conceivable.

These are facts. And yet there are people still left in business who balk at the expense of a cost system!

A cost system is the most valuable bit of insurance a concern can have, for it is an insurance against expensive mistakes, and when properly designed and operated, the expense of this insurance is less in proportion to its benefits than that of any other kind.

In these days of close margins and keen competition, you can not afford to be ignorant of facts as vital as those concerning your costs of doing business. Some one or more of your competitors—a beginner with a smaller business perhaps—is sure to know his costs;—and once he pits this knowledge against your guesses he is certain to win in the long run. Knowledge is power. The beginning of managerial wisdom is the knowledge of costs.



The most evident reason for an accurate cost system is the necessity of covering more than the cost of the product in the selling price.

To be sure, one may wait until the end of the year, and after taking into account the inventories at the beginning and end of that period, and the entire income and the expenditures, arrive at a conclusion as to whether or not a profit has been made.

In the absence of a cost system, however, such a conclusion relates only to the business as a whole, and does not enable one to know whether any particular line of the product has been sold above or below cost.

HERE IS ONE OF THE CHIEF BENEFITS USUALLY SECURED FROM  
A GOOD COST SYSTEM CORRECTLY HANDLED

One of the first facts that a cost system usually shows the management, is the fact that if several lines are being manufactured, certain of them are profitable and others less so, while some are being sold at cost and some at actual losses. The value of such knowledge as a guide to the development or suppression of each line is apparent.

In order to estimate on new work, it is necessary to know the cost of each element that goes into it. That this knowledge is not general is evident from the very widely divergent estimates made on the same thing by different companies; as, for instance, in the case of government work where estimates on the same battleship may vary by as much as one million or two million dollars.

Such a marked variance is not due entirely to differences in the cost of labor and materials, and in the efficiency of the management: it is due rather to the fact that the bidders do not really know the cost of their work. This condition is not by any means confined to shipbuilding concerns. It is found in practically every type of industry, as may be verified by anyone at any time by simply submitting specifications to different concerns for estimates.

A leading foundryman in Pittsburgh once said to me: "I have offered to install cost systems for all of my local competitors. It costs me more now to try to meet their inaccurate estimates based on their inaccurate costs, than it would for me to hire cost experts for all of them."

An accurate cost system faithfully reflects the changes, not only in the cost of materials and labor, but in the efficiency of operation and management from one period to another. It is therefore a valuable guide to the manager, directing him where and when to apply his particular attention to these details. This important use of cost accounting was pointed out by Babbage back in 1832. He says:

"One of the first advantages which suggests itself as likely to arise from a correct analysis of the expense of the several processes of any manufacturer, is the indication which it would furnish of the course in which improvement should be directed. If a method could be contrived of diminishing by one-fourth the time required for fixing on the heads of pins, the expense of making them would be reduced about thirteen per cent; whilst a reduction of one-half the time employed in spinning the coil of wire out of which the heads are cut, would scarcely make any sensible difference in the cost of manufacturing of the whole article. It is therefore obvious that the attention would be much more advantageously directed to shortening the former than the latter process."

HOW A COST SYSTEM HELPS YOU TO DECIDE WHETHER OR NOT  
CHANGES IN DESIGN OR METHOD ARE DESIRABLE

This quality of reflecting the effect of changes is valuable in determining not only what alterations of method and materials should be made, but also in deciding the effect of changes in design, whether developed in the plant itself or suggested by customers. If the cost of such changes were more accurately known, manufacturing concerns more generally would be doing manufacturing instead of making or jobbing, and salesmen would not be so free in acceding to the frequently



unjustified requests and demands of customers, while the profits which ought in theory to accrue from the business would more often become substantial realities.

One of the most successful shoe concerns in New England is gradually succeeding in standardizing its product largely because it is able, with an accurate knowledge of its costs, to point out to buyers the expensiveness of even slight changes in design and material.

It often happens, of course, that changes in the cost of material, labor and design are due to causes beyond the control of the management. In this case also it is highly important that the management should know exactly what the effect of these changes will be on the cost of the finished product, so that they may trim their sales or their prices accordingly.

CUTTING DOWN ON LABOR AND EQUIPMENT THROUGH  
AN ACCURATE KNOWLEDGE OF COSTS

This knowledge told one concern when to substitute dictating machines for stenographers. It has led to substitutions of one material for another when primary costs have become disproportionate to the value of the product, and it has made clear the profitableness of even such slight changes in equipment as that which saved two inches of copper wire per coil in an electric specialty shop.

One of the most important uses of a good cost system is the information it gives regarding the extent to which the resources of the producing end of the business are utilized by the sales end. That is, the proportion of time the equipment and buildings are idle is an accurate index of the degree in which the manufacturing organization is fitted to market conditions. When business is dull, direct labor can be laid off and supplies of raw material may be reduced; but it is difficult and inconvenient to alter buildings and equipment to fit these fluctuations. When the cost accounting system is such as to show the cost of idle equipment and plant, it may be a most effective spur to the sales organization to increase sales or to the manage-

ment to dispose of its surplus equipment and plant if possible.

E. A. Barker in *FACTORY* for November of 1915, called attention to a wide-spread practice in the use of costs: namely, an unwillingness to act on the real significance of the facts when those facts are unpleasant.

He says: "Favoritism is the third weakness in the use of costs. There is scarcely a manufacturer who has not found himself at one time or another making excuses or allowances for permitting a high cost on some favorite article or operation.

HOW ACCURATE COSTS INFLUENCE THE PRODUCTION OF SEVERAL LINES  
OF ARTICLES, WITH RESPECT TO THEIR SALE AT A PROFIT

"A manufacturer recently was shown that he was producing a certain article at a heavy loss. He refused to discontinue its manufacture because he had made his reputation and most of his money on it. Changing conditions, however, made a loss unavoidable. Yet he made all manner of excuses, apologies and allowances, until the loss in question seriously threatened the existence of his business. Then, and not until then, was the drag cut loose, and the business brought about and put on a paying basis.

"Some managers dislike cost figures which do not support their preconceived views, but no purpose is served by ignoring positive cost returns. The part of wisdom lies in accepting the discouraging costs, and then setting about to remedy the conditions which are responsible.

"Not long ago an engineer was talking with a manufacturer about costs. Though over two hundred different articles were made by this manufacturer, costs were obtained strictly on an average basis. The engineer pointed out that although the books showed a fair profit on the whole volume of business, undoubtedly some of the two hundred articles were being produced at a loss.

"The manufacturer replied that such might be the case. The engineer then asked him if it would not be a benefit from



the control point of view to know the exact cost of the different lines.

“‘If I did know,’ was the answer, ‘there would be certain lines I could not sell.’ Surprised at this remark, the engineer asked for an explanation.

“‘Every article I produce now I am selling at a profit. I would not sell goods below cost.’

“This seems a strange process of reasoning. Yet, there are many who deliberately deceive themselves by similar logic, and seem to take pleasure in so doing.”

## II

### WHAT ARE COST ACCOUNTS?

The chief distinction between financial accounting and cost accounting is that the former deals exclusively with the money and credit transactions of a business, while the latter deals with these same transactions, but with reference to the cost of products and operations. The unit of financial accounting is the unit of money, whether the dollar, the pound or the franc, while the units of cost accounting are the units of money plus the units of operations, of sales, of product and of time.

The fact that cost accounting includes some of the elements of financial accounting makes possible the interlocking of cost with financial accounts. This is indispensable for checking purposes, and without it a system of cost accounts may easily, and often does, go completely astray.

The object of cost accounting is to charge each element or unit of product with its share of all the expense to which the business has been subject, inasmuch as there is no certainty of making a profit on the sale of the product unless all this expense is absorbed in it and covered by the selling price.

The kinds of costs that a manager wants to get vary not only with the type of industry, but within each industry itself according to the purpose for which they are wanted.

In a continuous or tonnage type of industry the aim usually is to ascertain the cost per unit of weight or length for each of the comparatively limited number of products, such as tons of





### HOW THE WORK IS DIRECTED

*In this room the work of a factory in the Middle West is mapped out. The two men are receiving instructions which are marked with a time stamp. The boards are arranged by machines, and provide for instructions covering three jobs,—the one in hand, the one next ahead, and even the second ahead. These instruction cards are advanced or disposed of as the work progresses*

## HOW TO FIND FACTORY COSTS

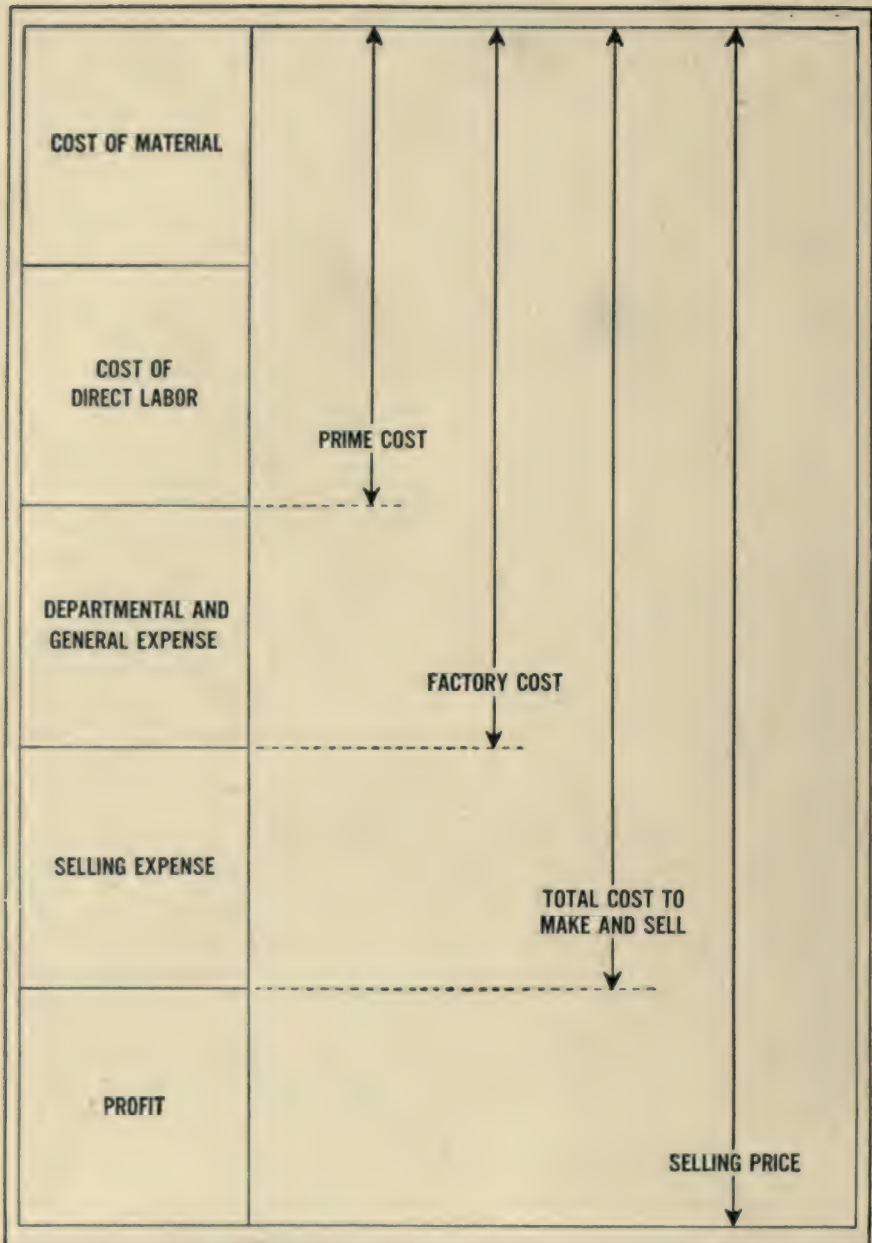


DIAGRAM I

*Here is a graphic representation of the main components of the selling price and their relations to each other. On page 23 you will find a detailed explanation of this diagram.*



castings or yards or pounds of yarn or cloth. This result is attained by getting departmental costs on the product as it makes its way through each department, totaling these and adding to them the general administrative expenses to secure the entire factory cost. These costs are specific in so far as they relate to individual lines of product.

HOW A PROPERLY ARRANGED COST SYSTEM ENABLES YOU  
QUICKLY TO GET TOTAL FACTORY COST

The other type of industry, the assembling type, is not so much interested in general costs as it is in specific job costs and the cost of operations. To be sure, in some instances where the product is uniform, or consists of only a few lines of articles comparatively simple in their construction, it may be sufficient to get general costs in much the same way as in a tonnage industry. But, as a rule, in assembling plants the types of product are numerous and varied, and it is important to get the cost of each individual line and each operation on each line. The sum of the operation costs, added to the cost of materials, plus that proportion of the specific departmental costs and the general administrative expenses which should be apportioned to the unit of product under consideration, constitutes the total factory cost of such product. A properly contrived cost system makes it possible to secure these costs in minute detail and to combine them quickly and accurately in whichever way is the most useful for the particular purpose in hand.

There are types of industry in which it is advisable, either on account of uniformity of the product, or for the exactly opposite reason—the extreme diversity of the product—to take costs on typical items only. This is the case with a company manufacturing low-grade pottery, such as flower pots, and with another which makes machine specialties.

One fact that has retarded the extension of cost accounting is the unnecessary and the expensive refinement to which it is sometimes carried. There can be no objection on principle to

red tape when that tape is necessary to tie together the organization; but sometimes there may be too much of it, more than is either necessary or useful.

It must be clearly recognized from the start that any cost system involves a considerable element of judgment and can not therefore be as accurate as are engineering specifications which are based upon natural laws. There is bound to be an uncertain percentage of error in every cost estimate no matter how much care is taken to make it accurate. This being the case, it is a waste of valuable time and energy to attempt to make each detail of the estimate absolutely correct. The fact is that no amount of effort is going to eliminate inaccuracy from all the details, and unless all the inaccuracies are on the same side—plus or minus—they are pretty apt to offset each other, so that the net result will not be far from the truth.

This principle is laid down, not as an excuse for the rough approximations that sometimes go by the name of "cost accounts," but as a warning against over-refinement.



### III

## WHAT GOES TO MAKE UP YOUR COSTS

Costs are made up of combinations of units of time, such as the hour, day, week, month or year; of product, such as the yard, ton, piece, machine or job; of production, such as the operator or the operation; and of money. In many cases, several of these combinations of units are used at once, as when the daily costs are accumulated in weekly or monthly summaries.

It is not uncommon in textile plants to get costs both by the ton and by the job. Sometimes one unit may be used in certain departments of a plant while other units are the bases of costs in other departments of the same plant. For example, costs may be had by operators in departments where hand-work predominates and by operations where work is mainly by machine. The one universal and invariable element is money, and as money is the unit also of the commercial accounts, it is the money statement of costs which makes possible the interlocking with commercial accounts which is necessary as a check on the accuracy of the costs.

It is customary to divide total cost into two main elements: factory cost and selling cost, which, taken together, and with the profit added, constitute the selling price. (See Diagram I.) Factory costs again are usually divided into prime costs and indirect expense. The latter includes all the expenses of administration and supervision. It is also variously known as

"overhead," "burden," and "non-productive" expense, and comprises all expenditure for labor and materials which does not enter directly into, nor is sold with, the product. This expense is further subdivided, in some cases, into departmental expense: that is, all indirect expense which may be charged directly to a department, and administrative expense, which includes all other indirect factory expense.

Administrative expense is still further analyzed into auxiliary expense, which includes all indirect expenditures actually necessary to the running of the plant, such as those for power, stock-rooms, and the like, and administrative expense proper, which covers those departments necessary for the handling of the business, but in the absence of which the factory, as such, nevertheless could be run physically. To this latter class belong the expenses for accounting and legal departments. The line between these is sometimes difficult to draw, and in any case this is a refinement which often may be unnecessary. (See Diagrams II and III on pages 26 and 28).

DISTINGUISHING BETWEEN "PRODUCTIVE," "NON-PRODUCTIVE,"  
AND "SUPERFLUOUS" COSTS

Just a word as to the use of the term "non-productive." Any expenditure for labor or material is either necessary for the efficient management of the plant and the making of the product, or it is entirely superfluous and should be eliminated. If the expenditure is necessary it must be in some sense productive.

This is fairly obvious even to those who insist on using the terms "non-productive" and "non-producer." Nevertheless those terms seem to carry some kind of stigma, involved in the suggestion that there is necessarily something wasteful about "non-productive" expenditures. There follows a tendency to reduce "non-productive" expense to a minimum which is really inconsistent with the proper management of a plant.

A favorite method of doing this is to have most of the alleged non-productive work performed by so-called "productive"



labor, as when an operator is required to do his own planning, get his own materials, and the like, thus charging this work to "productive" accounts and incidentally losing all possibility of controlling it. When this type of necessary activity is called "indirect" rather than "non-productive," there is not the same implication of wasteful and unnecessary expenditure. There is no longer the same objection to bringing it out into the open, charging it properly, and organizing it for the most effective control.

Direct costs are chargeable easily and immediately to the product, while indirect costs, which must be included in one way or another, have to be added by some method of distribution. It is perfectly evident what materials and what labor go directly into the product. Hence the securing of direct costs is easy and common.

Most of the simple cost systems, one-form systems and one-man systems, so dear to popular business literature, deal exclusively with this necessary but obvious detail. In view of the fact, however, that indirect costs may amount in some instances to as much as two or three hundred per cent of direct costs, failure to take them into consideration may lead speedily into bankruptcy.

NEGLECT OF THE "INDIRECT COST" MADE A DIFFERENCE OF 30%  
IN THIS BUSINESS MAN'S OVERHEAD

Recently an automobile agent assured me that he was losing money in his "service-station," and, although he had a cost system, he could not locate the leak. A series of questions soon brought out the fact that the 80% he was charging for overhead had omitted such items as rent, interest on stock carried, work done under guarantee without charge, work done for the sales department, and idle time. When these items were included, the percentage to be added to direct labor on account of overhead turned out to be 110% and on this basis seventy-five cents an hour would just barely pay expenses if his men were occupied all the time.

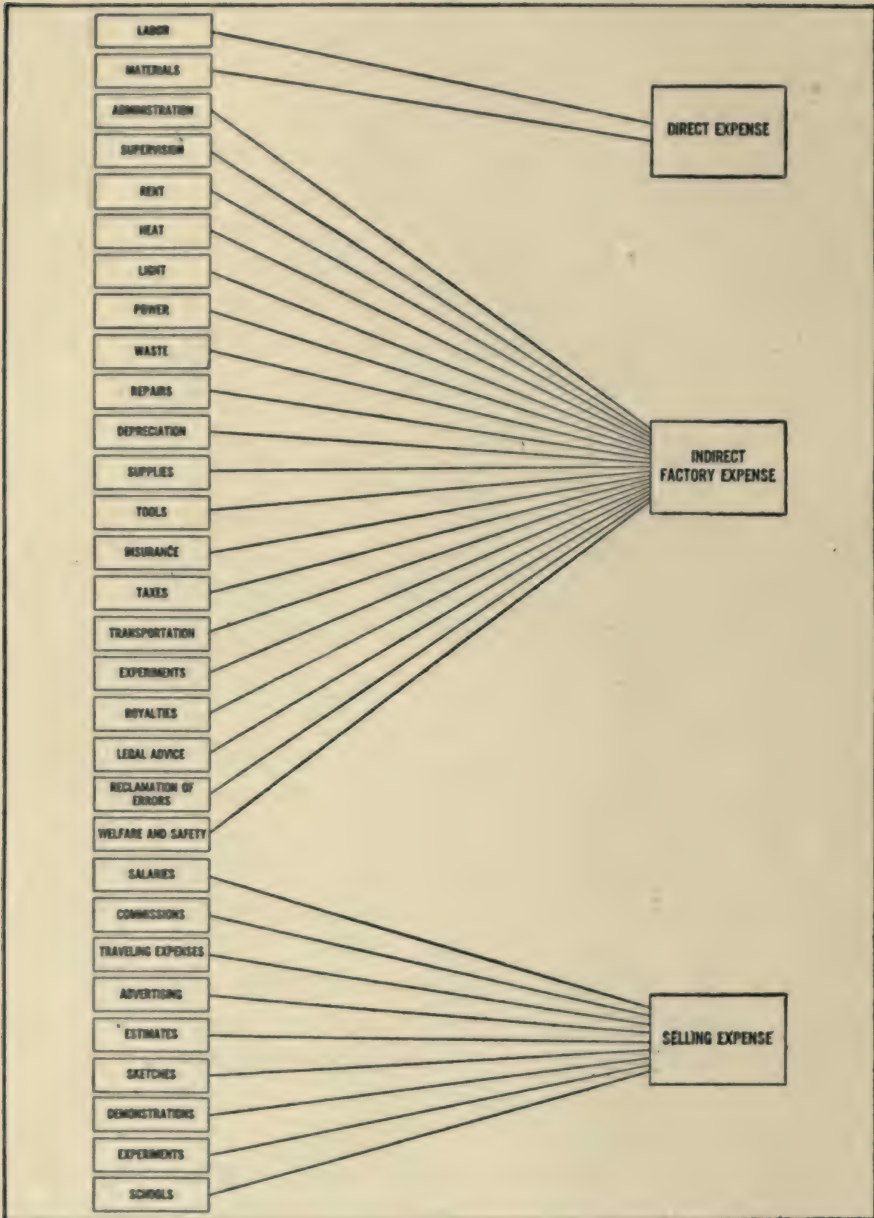


DIAGRAM II

*This is a graphic analysis of the main constituents of direct expense, indirect factory expense and selling expense. This diagram should be considered in connection with Diagrams I and III.*



To find out what these indirect costs are, and to get them into the selling price of the product, through which they must sooner or later be recovered, and to do this accurately and with justice to the various items of the product concerned, is no simple or easy matter, while at the same time it is just as necessary as the ascertainment of direct costs. Simplicity is a relative virtue only. What is appropriately simple for a child is puerile for a man. With an increasing complexity of conditions there must go a corresponding complexity of system. A cost system should be as simple as is consistent with effectiveness.

HOW KNOWLEDGE OF TOTAL COST HELPS TO FIX THE  
SELLING PRICE AT A PROFIT

The components of total cost, then, are direct expense, including labor and materials; indirect factory expense, including cost of administration, supervision, rent, heat, light, power, waste, repairs, depreciation, supplies, tools, insurance, taxes, transportation, experiments, royalties, legal advice and reclamation of errors; and, finally, selling cost, including salaries commissions, traveling expenses, and the cost of advertising, estimates, sketches, demonstrations, experiments and "schools." When the proper share of indirect factory cost and selling cost is added to the direct labor and material cost of the product, and the margin of profit added to these, we have the selling price.

Methods of finding direct labor and material costs will be discussed in this chapter, while methods of finding and distributing indirect costs will be developed in succeeding chapters.

There are two ways of finding direct labor costs, depending on the nature of the product. With a tonnage product, the total of the units produced in a given time, say a day, week or month, is divided into the total of the labor cost of the workmen actually engaged on that product during the given period. This gives a direct labor cost per ton or per pound.

## HOW TO FIND FACTORY COSTS

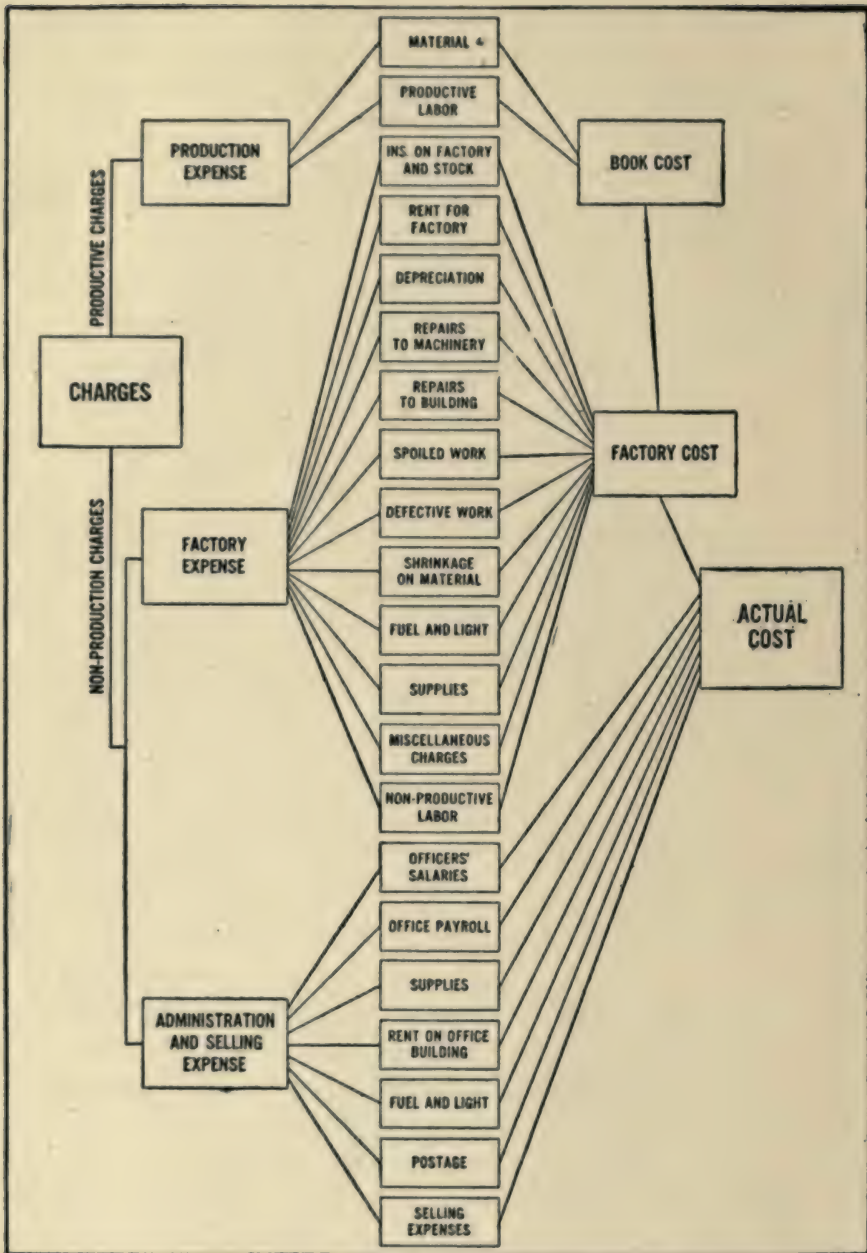


DIAGRAM III

*This diagram pictures another classification of factory costs and will prove most helpful when used in connection with Diagrams I and II and the detailed explanation on page 24.*



The time spent by the workmen is ascertained from their daily time cards (Form 1); and the statements of the workmen or foremen, or of both, to the effect that their time was spent on the work under consideration, are accepted. In some cases the time card alone is used, for it is assumed that if the men were in the plant as shown by the cards, they could only have been engaged on the lot or order known to be under way in their departments.

THE RESULT OF CARELESSNESS IN CHECKING JOB CARDS AND HOW IT  
AFFECTS THE INDIRECT LABOR COST

In the types of industry where it is desired to get more specific costs on parts or units of products, it is customary to use the daily time card showing the number of hours the workmen were present in the plant, and usually to supplement this by a daily job card on which the operator notes the number of jobs that have passed through his hands during the day and the time he has spent on each (Forms 2, 3 and 4). This record, usually O. K'd. by the foreman, is turned in to the factory office at the end of the day, or at the completion of the job, if more than one day is required for the work, and posted in the cost department to the summary sheet, which, as explained later, summarizes the direct cost and the portion of indirect expense chargeable to each job.

While these methods are fairly effective, they are as a rule quite inaccurate, especially where there are a large number of jobs going through each operator's hands in the course of a day; but, what is more important, they usually fail entirely to account for that portion of the operator's time which is occupied with indirect labor or which is genuinely non-productive—that is, idle.

The operator who sits down at the end of the day, or even at the end of the morning, and attempts to fill out his job card with the number of orders and the time spent on each, is usually more intent on showing he was working on something every minute while he was in the plant, than in figuring the number

## HOW TO FIND FACTORY COSTS

JOB CARD							
NO.		ORDER NO.					
ALLOWED				WAGES			
TAKEN				AT			
PREMIUM				BONUS			
TOTAL HOURS				TOTAL			
DAY		IN	OUT	IN	OUT	TOTAL	
F	A. M.						
	P. M.						
S	A. M.						
	P. M.						
Sun.	A. M.						
	P. M.						
M	A. M.						
	P. M.						
T	A. M.						
	P. M.						
W	A. M.						
	P. M.						
T	A. M.						
	P. M.						
NAME							
WEEK ENDING							
FOREMAN							

FORM 1

*This is a typical job card for use in connection with ordinary day or premium work.*

<p><b>Card No.</b> _____</p> <p><b>HELMAN, SIMPSON and Company</b></p> <p><b>Foreman's Report of</b></p> <p><b>Day Work</b></p>			
<p><b>Done by</b> _____</p>			
<p><b>Workman's No.</b> _____</p>		<p><b>Date</b> _____</p>	
<p><b>Commenced Work</b> _____</p>		<p><b>Quit Work</b> _____</p>	
Job No.	No. of Hrs.	Article	No. of Operation
<b>Total</b>			
<b>Foreman</b> _____			<b>Dept. No.</b> _____

FORM 2

*The foreman makes up this type of day-work card for keeping track of productive labor.*

[illegible]

FORM 3

Here is a type of work card which is made up by the workman and approved by the foreman. It covers both piece and day work, and provides for demeriting the operator with defective work.



of minutes taken on each job. The foreman's O. K. is generally nothing more than a formality.

"If work in a factory begins at half past seven, but the workman does not start his machine on a piece until seven forty, that job goes down just the same as beginning at half past seven. If the worker knocks off at eleven fifty, the job is charged up to twelve o'clock. If the machine breaks down in the course of the morning and is out of commission for half an hour, that time is charged to the job, just the same. If jobs are changed during the morning and twenty minutes delay is occasioned by not having materials or tools at hand immediately the finished job is taken off the machine, that idle time is sure to be charged to one or the other jobs."

This is what a foreman told me in explanation of his refusal to accept the job cards as indications of the time it really had taken to perform the work as detailed on them.

**MAKING SURE THAT JOB CARDS INDICATE THE TIME ACTUALLY REQUIRED  
TO PERFORM THE WORK**

For industries where it is important to know the exact cost, and especially for those which are so organized that they can take advantage of a real knowledge of the time occupied in actual production and that expended in indirect labor, whether productive or non-productive, it is advisable to use an individual job card for each job, order or lot (Forms 5 and 6). This card is changed each time a workman changes his job; except that in special cases where the operator works only a few minutes on each job, numbers of them may be grouped together and changed periodically.

This card contains, among other facts, the job number and the workman's name. It is stamped with the times the worker begins and ends his job. If there is serious interruption, the job card is taken up and a new one issued to cover the interruption.

The last card is again taken up when the job is resumed, while on the job card, or a duplicate, is carried the time actually

## HOW TO FIND FACTORY COSTS

[illegible]

FORM 4

*This card is used with Forms 2 and 3 to keep track of time consumed by non-productive work.*

IN	OUT	IN	OUT
----	-----	----	-----

## OVERTIME PERMIT

DATE Apr. 11 1916

CHECK No. 5800

W. Halsey  
*Foreman*

OVERTIME ALLOWED 2 1/2 HOURS

FORM 7

*This card shows in advance the amount of over-time allowed, and is signed by the foreman.*

IN OUT	C			
DEPARTMENT D M		IF JOB IS NOT FINISHED SCRATCH OUT THIS <del>W</del>		F
DAY RATE		IF JOB IS FINISHED SCRATCH OUT THIS <del>W</del>		N F
OPERATION	NO. OF PIECES FINISHED	MAN'S TIME	MACHINE TIME	MACHINE NO.
WORKMAN'S NAME		MAN'S NO.		
		D M		
I HAVE CHECKED THESE ENTRIES AND BELIEVE THEM TO BE CORRECT: Signed by Foreman or His Representative				
ROUTE SHEETS	PAY SHEET	COST SHEET MAN'S MACHINE		
DAY WORK			TIME NOTE	

CHARGE SYMBOL				
C				
ENT D M		IF JOB IS NOT FINISHED SCRATCH OUT THIS <input type="checkbox"/>		F
		IF JOB IS FINISHED SCRATCH OUT THIS <input type="checkbox"/>		N F
OPERATION		NO. OF PIECES FINISHED	MAN'S TIME	MACHINE TIME
WORKMAN'S NAME		MAN'S NO.		
		D M		
CHECKED THESE ENTRIES AND BELIEVE THEM TO BE CORRECT:				
Signed by Foreman or His Representative				
BONUS RECORD	PAY SHEET	COST SHEET		
		MAN'S	MACHINE	
BONUS WORK				TIME NOTE

FORMS 5 AND 6

The planning department issues these job cards for day work and piece work. The job number is entered opposite "C;" the time issued is stamped after "In," and the time completed after "Out."



taken on the work in hand. This gives an accurate record, not only of the work done, but of the losses of time from delays, whether necessary or unnecessary. As such, it is the basis of accurate labor costs, besides serving several other purposes in the administration of the work which are beyond the scope of this discussion.

Not the least among the advantages of this card is the fact that it eliminates the costly time card system used to show the time the workman enters and leaves the plant. The job cards are made out the day before, or overnight, for each workman and are stamped with the opening time in the morning. These cards are placed in racks under the workman's number.

The racks are opened so that each man gets his card as he enters, showing the job on which he is to begin and the time he entered. At opening time, say at seventy thirty, the racks are closed and all cards not yet taken out by workmen are sent to some part of the factory office, to which all late workmen have to go to get a card on which to do their work and draw their pay. This card emphasizes their lateness, and being stamped with the time they actually begin, allows for appropriate deductions on account of tardiness.

ONE MANAGER, USING THIS SIMPLE DEVICE, PREVENTED WORKMEN FROM  
TURNING IN EXCESS OVERTIME

Accounting for overtime presents no great difficulty, as it is usually taken care of by spaces on the job cards, or separate overtime cards, and by additional spaces on the payroll sheets. Every manager knows, however, the great temptation that workmen are under to get as much overtime, at straight rates or "time-and-a-half," as they can squeeze in, and how easily foremen become careless about checking this tendency. The "overtime permit" (Form 7) shown on page 32 provides a means of control at the same time that it gives a record of the overtime actually put in. It must be signed by the foreman, and indicate in advance the number of hours of overtime to be allowed. By looking over these cards fairly often the super-

## HOW TO FIND FACTORY COSTS

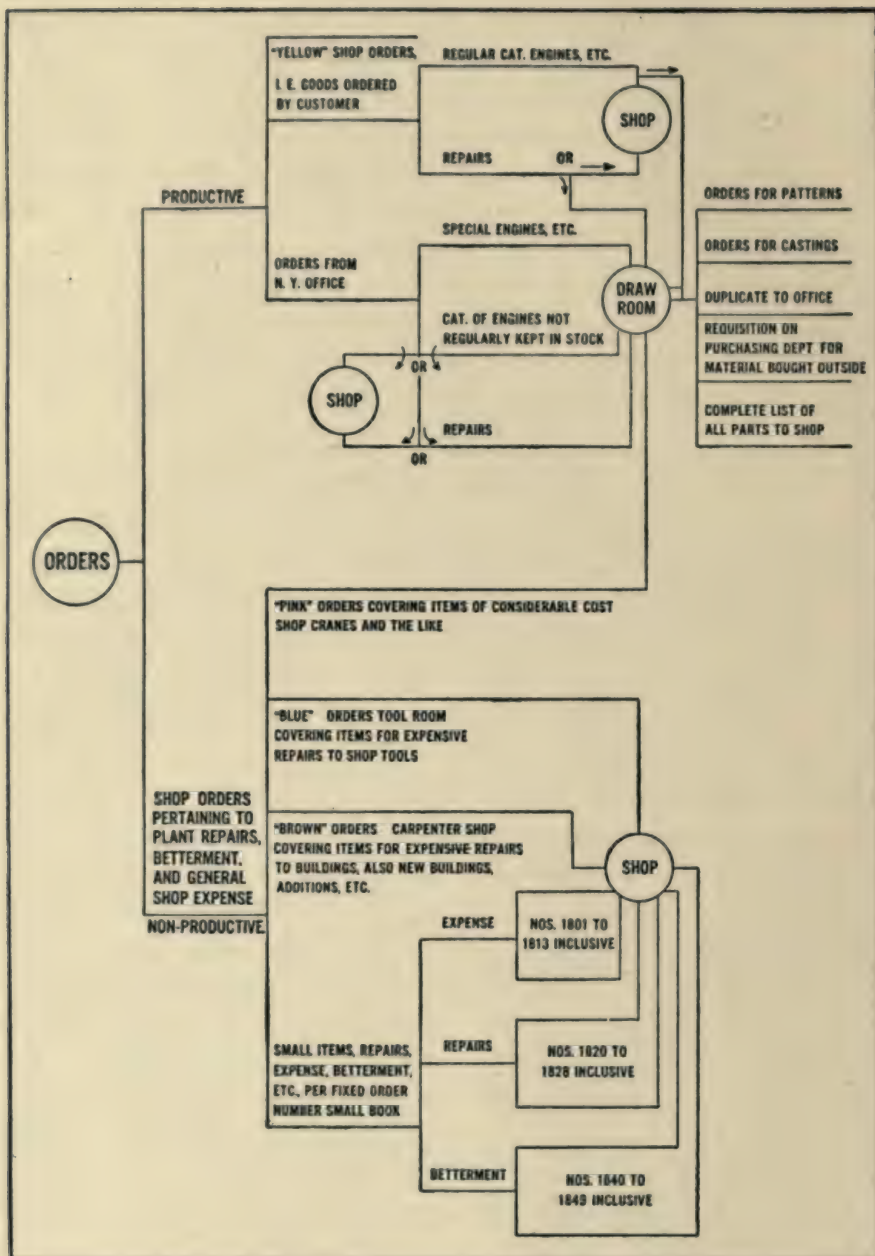


DIAGRAM IV

*This is a diagrammatic analysis of one company's order system. In conjunction with a rule book for charging time, it supplies this concern's key to the recording and figuring of all its costs.*



intendent or manager can keep close track of the overtime, and quickly stop any tendency toward abuse.

It is usually advisable to chart the course followed by job cards and orders so that all clerks handling them may know exactly what they have to do, where the cards and orders come from and where they have to go. These charts are as useful for office work as routing diagrams are for showing the course of the product through the factory. Diagrams IV, V and VI show how orders, job cards and material are routed through one plant. With such a chart and instructions it is harder for a clerk to make a mistake than it is to do the job right.

WHY IT IS OF GREAT IMPORTANCE TO MAKE SURE THAT EVEN THE SMALLEST  
ITEMS ARE REPRESENTED IN YOUR FINAL COST FIGURES

For some curious reason, accuracy in accounting for materials is not generally considered as important as in accounting for direct labor. Every manager likes to feel that every minute of the labor that he buys is accounted for on some order, but it does not seem to worry him if two or three per cent, or more, of his materials is unaccounted for, or if even a larger portion is charged wrongly. Why this should be so, when materials cost real money just like labor, is one of the puzzles of current managerial practice.

Perhaps one explanation lies in the fact that so few concerns have adequate facilities for the proper storage and handling of materials. Money must come in and be stored in definite places in the safe or the petty cash drawer, and the same is true of stamps, probably because they have the price marked on them and may pass for money.

Yet raw materials, whether intended to go into the product or into supplies, and partly finished stock waiting for assembling, may be, and frequently are, dumped anywhere according to the convenience of the foremen or the truckmen, are issued to, or taken by, anybody who may be presumed to have a use for them, and accounted for or not, according as to whether or not anybody has the time or willingness to make the proper

## HOW TO FIND FACTORY COSTS

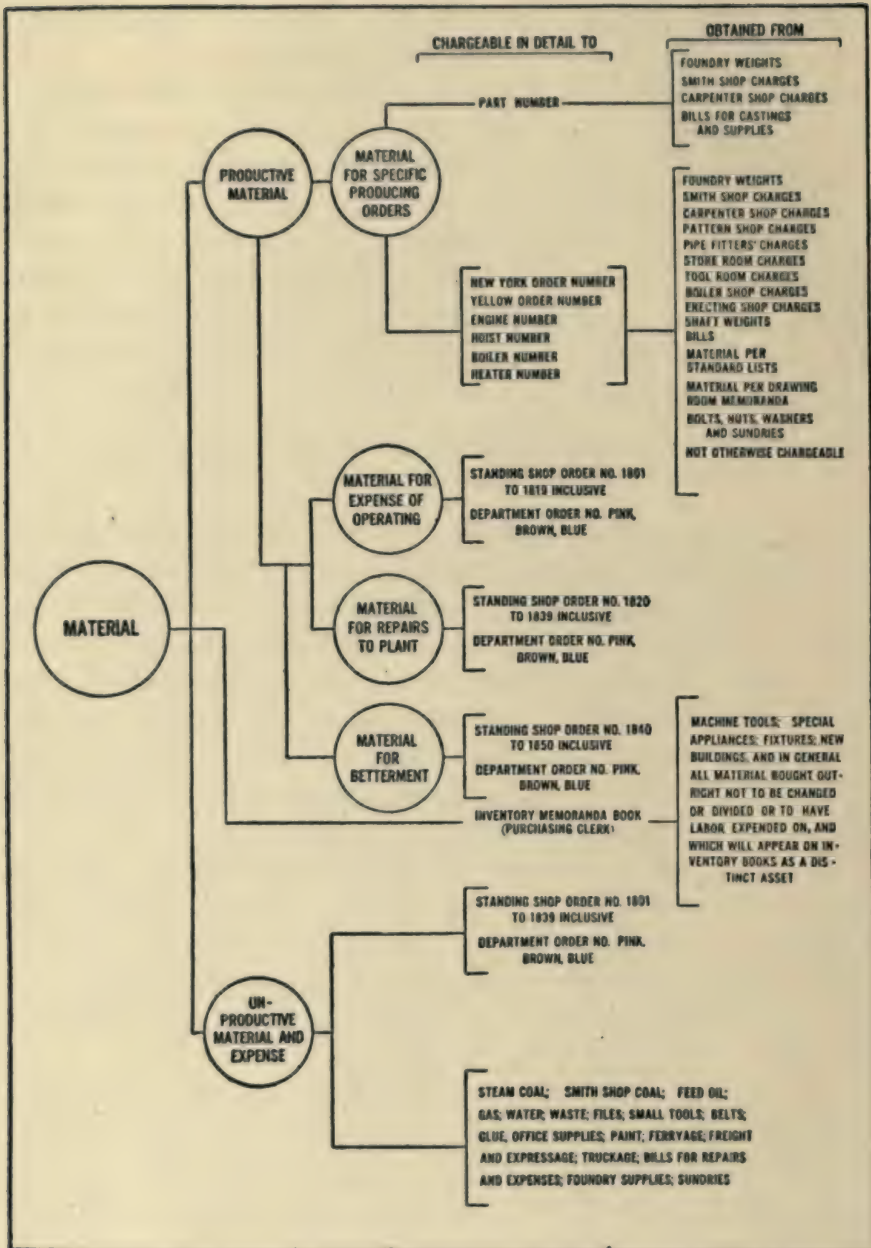


DIAGRAM V

*Here is a graphic representation of one plan for subdividing labor charges throughout a plant  
A diagram of this type may prove very helpful when figuring your own costs.*



records. Under these conditions it is obviously impossible accurately to keep track of all the materials handled.

The first requisite in accounting for materials is some form of stores system by which all materials are kept definitely in charge of responsible storekeepers and are issued only on written orders specifying the lot or job on which they are to be used (Forms 8 and 9). Some kind of a perpetual inventory by means of which a record is constantly kept showing the receipt and disbursement of materials, is a necessity for other purposes than those discussed in this book and is a useful adjunct to cost-keeping.

**THE USE OF THIS PERPETUAL INVENTORY ELIMINATES ANY CHANCE  
OF MATERIAL BEING MISSED**

This perpetual inventory may vary in detail and completeness all the way from a simple card or sheet showing amounts received and amounts issued, with balances and dates (Form 10) to the elaborate balance sheets used in the most advanced forms of management, which show the amounts ordered on single orders and accumulated orders, requisition numbers, purchase order numbers with dates and prices; quantities received, with dates; quantities issued, with dates and order numbers on which issued; prices per unit and per issue; quantities reserved for orders to be executed in the future, together with dates of reservations and of issue, and order numbers; quantities available for reservation, which is the difference between quantities on hand, plus those on order, and amounts reserved; and, finally, the total quantity of material required for the execution of all orders on hand, from which is deducted the quantity purchased on each separate order, leaving the amount still to be bought (Form 11).

All materials should be issued on written requisitions showing the order number for which issued, date, quantity, and the price of the issue, this price including freight and expense, as well as purchase prices (Form 9). These prices can be taken from a perpetual inventory sheet which takes them from pur-

chase orders and freight and express vouchers, or, if it is not desired to have this information available to perpetual inventory clerks, they should be at hand in the cost department where they will be entered on each requisition after the materials have actually been issued. From these requisitions the prices are posted to cost summary sheets for each job in the same way as direct labor.

An important detail in this connection is the proper handling of credits to a production order. It frequently happens that more materials are issued to an order than are required by it. The surplus is either returned to stock or used on another order: in either case, the order originally charged with the material should be duly credited with that which is not used and the storeroom or the other order debited.

#### HOW MATERIAL FORMERLY WASTED IS ACCOUNTED FOR

In many industries, the wastage of material incidental to manufacturing operations is so considerable as to demand special attention. If the waste can not be sold or otherwise reclaimed, it is not necessary to make a special charge for it, as it is already accounted for in the requisition charged to the order. If it can be reclaimed, however, it should be treated as a new product, credited to the order, and debited to the storeroom to which, when disposed of, it will be credited (Form 12).

The total of all charges for materials used, together with the inventory of materials on hand, should balance with the ledger accounts of stores purchased. This ideal condition is, at the best, hard to attain. In the absence of a well-kept perpetual inventory, however, it is practically impossible. Owing to the careless handling most materials receive and the inaccuracy of perpetual inventory clerks, it is absolutely necessary that the inventory be frequently checked and the amounts shown to be on hand by the books made to square with the amounts shown to be on hand by actual count.



It is not desirable to make this comparison once a year only, at the time of the traditional annual inventory. Annual inventories are notoriously inaccurate, as well as exceedingly expensive in labor cost and the wastage of valuable productive time. A perpetual inventory should be checked by frequent physical counts of parts of the materials on hand. (Form 13.) If the entire stock is divided into twenty-six lots, and one of these lots is checked each day, the entire stock will be checked and covered once a month.

This is but one of the numerous checks which may and should be used. Suffice it to say that it is just as important, both from the financial and the manufacturing points of view to keep accurate inventories of materials in stock, as it is to account accurately for the money which passes through a concern.

## IV

### HOW TO HANDLE INDIRECT COSTS

Direct or prime costs having been ascertained as suggested in the preceding chapter, it is necessary to add indirect costs, including all the expenses of administration, supervision and operation which are necessary for manufacturing the product, in order to determine the total factory cost. Indirect expenses include such items as salaries of executives, superintendents, foremen, storekeepers, inspectors, janitors, and the like; the cost of heat, light, power, repairs, supplies, and the like, and such fixed charges as rent, depreciation, and perhaps interest. When to these is added selling expense, we have the total cost to which profits are added to make the selling price.

Depreciation, interest, and selling expense will be discussed in the following chapters; the other indirect expenses, in this.

While a few plants still figure their expenses on a yearly basis, it is becoming more and more the practice to make them up monthly, or by four-weekly periods, and even, in a few instances, weekly. Of these methods the monthly or the four-weekly periods are usually the best, as they not only make it possible to keep better posted on the exact condition of the business, but, what is more important, they enable the management to take immediate steps to remedy disadvantageous conditions within a short time after they are discovered. It does not do much good to learn in March of this year that power costs were excessively high in March of last year; whereas, if



the fact had been known in April of last year, remedial steps could have been taken immediately.

One big machine shop was getting its scrap and spoiled material reports at irregular intervals, usually from four weeks to ten weeks after the damage had been done. When daily reports were substituted, it became possible for the first time to trace to their sources the causes of the unusual amount of waste in this plant. The carelessness of the workmen and foremen and the deficiency of equipment and machines also could be brought home immediately and remedied.

The advantage of a four-weekly period over a monthly period lies in the fact that the periods are all of equal length, thus making exact comparisons possible. In some plants each three months may be divided into two periods of four weeks, and one of five weeks, in order to avoid the inconvenience of splitting a weekly payroll at the end of calendar months.

The truth is, that if costs are accurately kept it makes not much difference in most cases which of these methods is used, and it will be assumed in this discussion, for the sake of simplicity, that the calendar month is the unit.

HERE IS A CLEAR EXPLANATION OF HOW ADMINISTRATIVE  
EXPENSE IS DISTRIBUTED

The costs of administration include the salaries of executive officers, such as the general manager, superintendent, office-manager, foremen, bookkeepers, clerks and planning-department officials, and are taken directly from salary vouchers and the payroll. It sometimes happens that the time of the chief executive officers, such as the president, the treasurer, and occasionally the general manager, is divided between manufacturing and sales or financing. In this case the proportion of the time of these officers chargeable to manufacturing should be estimated with a reasonable degree of accuracy and only that time charged to factory expense.

There may be certain administrative expenses, such as those for taxes, insurance, and legal advice, which are covered by

## HOW TO FIND FACTORY COSTS

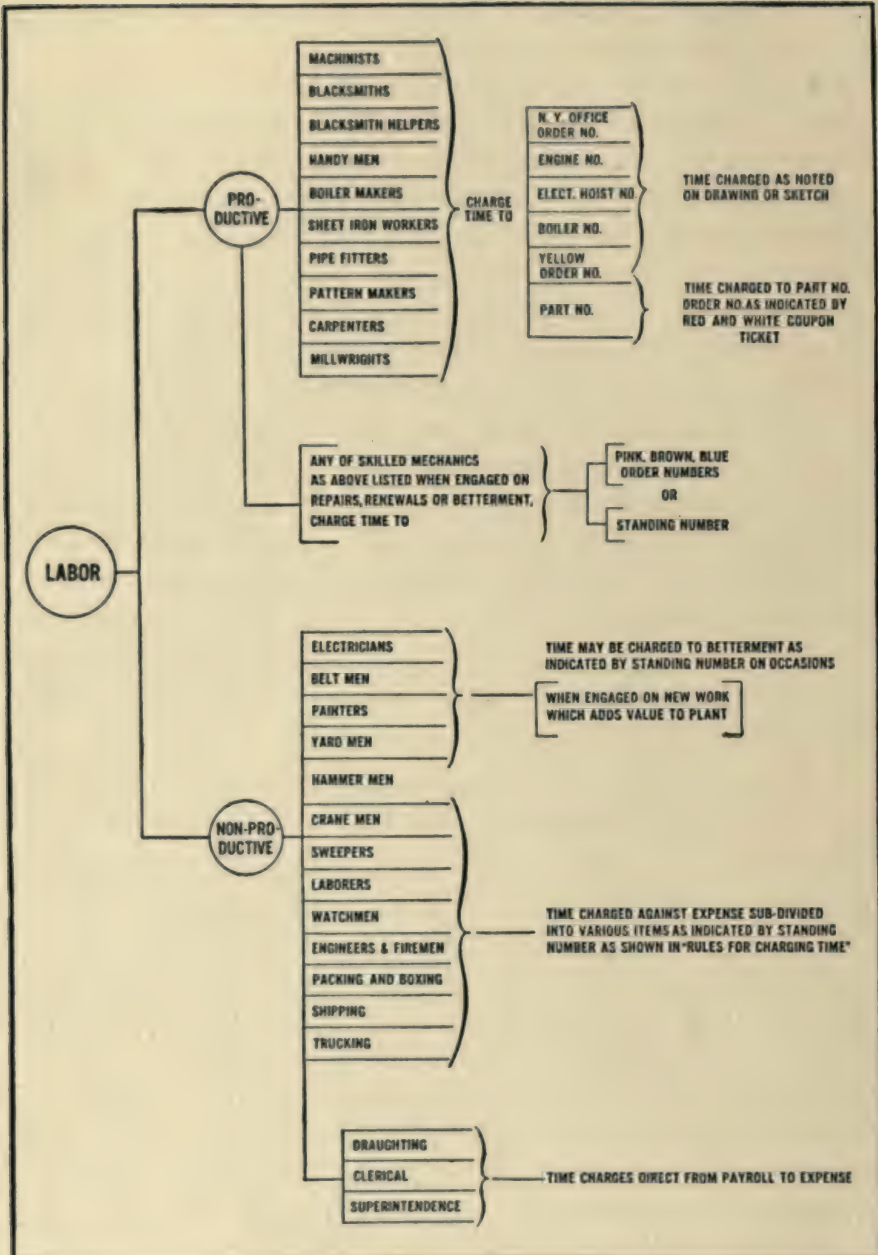


DIAGRAM VI

*This diagram shows a typical division of material under various classes that designate the use to which it is finally put. The sources from which the charges issue are also indicated.*



yearly charges, in which case the expense should be prorated equally over each month. There also may be an expense for expert services varying in amount at different times during the year. Unless such services are to be considered as a capital investment, their probable yearly amount should be estimated and prorated, any necessary adjustment to be made at the end of the year, either by charging it to profit and loss, or by adding it to the following year's estimate.

Supplies used by administrative departments should be issued to them on requisitions exactly as materials are issued in the factory. The requisitions should show the department to which the supplies are charged, and their total for the month constitutes the monthly charge against the department.

Every department should be charged with a share of the rent proportionate to the number of square feet of space occupied by the department. This is true whether a concern owns its own plant or rents it.

THE BEST WAY TO HANDLE THE RENT ITEM WITHOUT  
CHARGING IT TO PROFIT AND LOSS

While a good argument might be made for charging rent, when it is paid to an outsider, to profit and loss, on the ground that the owner of the land and building is to that extent a partner in the enterprise, it is recommended that the current practice be followed, which is that rent be considered an element in the cost of production. If it is so considered, it is just as much an item of cost when the concern owns its own plant as when it rents it from another. Care must be taken, however, when rent is charged for a plant owned by the concern, that there are no duplicate charges for interest on the investment in land and buildings, and for depreciation, both of which are already included in the rent charge.

The question is sometimes raised whether all departments, direct manufacturing and indirect, should be charged with rent, or whether the entire rent charge should be distributed over the direct manufacturing departments only. The argument is





## 45

[illegible]

*This card illustrates the simplest form of perpetual inventory. Provision is also made for indicating the maximum and minimum amounts.*

[illegible]

*An example of the elaborate balance sheet used in some of the most detailed forms of management. The information and directions it contains are unusually complete.*

that as the product of the direct manufacturing departments ultimately has to bear all the indirect expense anyway, it saves a certain amount of clerical work to charge the product immediately with as much indirect expense as possible, rather than charge one indirect expense on another indirect expense first, and then distribute the latter over the product.

In the case of rent, for example, it may be simpler to charge the rent of the space occupied by the general offices and accounting departments directly to "productive" departments, than to charge it first to the general offices and then distribute it, with other general office expense, to the departments which ultimately have to bear it. This policy is summed up in the rule: "Never charge an indirect expense to another indirect expense." Even when this rule is adopted, there must be important exceptions to it, as in the case of tool departments and experimental or development work.

The charge for power, heat, light, and ventilation is made up from the total power plant expense when the concern produces its own power, or from the monthly charges for these necessities when they are purchased outside. Power plant charges include wages and salaries of attendants, fuel, water and supplies, and depreciation, together with interest (if interest is charged) on the investment.

MAKING EACH DEPARTMENT BEAR ITS PROPER SHARE  
OF THE INDIRECT COSTS

This total cost must be distributed over departments. Heat and ventilation are usually charged in proportion to the cubic contents of each department. Light, power and water should be measured and each department, or in some cases each machine or work-place, charged with the proportion actually delivered to it. Where it is the practice to charge these expenses directly to the machine, general lighting should be charged to each machine in proportion to the total floor-space occupied by it.





### KEEPING THE WORK MOVING

*There are thirteen standardized operations or positions in the manufacture of a freight car in a factory in the Middle West. The first one is shown in this illustration. A pair of trucks are placed on one of the construction tracks; the completed car leaves the other end of the track—all the various stages in the building of the car follow one another in logical order*



### STEPS TWO AND THREE

*Positions two and three in the manufacture of a freight car at the plant referred to on the preceding page are here shown. Wagers are freely placed by the men, track against track, position two of track one against position two of track two, and so on down through the positions. This plan of progressive car building cuts costs twenty-five per cent, and promises even larger savings*



The cost of handling materials includes the salaries and wages of the purchasing department, receiving clerks, storekeepers, material ledger clerks, shipping clerks, and the traffic department, together with all supplies used by them, depreciation on equipment, and the rent of the space occupied.

The cost of transfer clerks, move-men, truckers, and of transportation equipment permanently located or used in a department, is usually charged as a departmental expense.

The methods of ascertaining all these charges are the same as for the productive departments. The method of distribution, which may either be an addition to the cost of materials, or a direct charge to the departments, will be discussed in a later chapter.

HERE ARE A NUMBER OF GOOD WAYS OF HANDLING  
INSPECTION COSTS

The cost of inspection is derived directly from the payroll. Inspection of product and of equipment should be charged, when possible, directly to the departments or jobs concerned.

There is a certain amount of final inspection which can not be charged directly to a department. This is an indirect expense which must be apportioned. A method as good as any is to apportion this general inspection charge to each department in proportion to the direct departmental inspection cost.

When it is desirable to charge inspection to a specific job or order, the inspectors should work on time-cards, the same as direct labor employees, and indicate on the cards the jobs or orders to which their time is to be charged.

The maintenance charge for the up-keep of yards, buildings, and equipment, including machines, benches, shafting, belting, piping, wiring, and the like, is taken from purchase orders for work done by outside help, or from job cards on which all repairs are done, and from requisitions for supplies and materials used for repairs. In other words, these charges

are ascertained exactly the same as if they involved production orders, and are then charged directly to the department or machine concerned; or, if they can not be so charged, they are distributed over departments or machines as will be shown in a later chapter. The cost of the janitor and the watchman should be charged to maintenance, and is usually one of the general charges which has to be distributed.

Spoiled material is any material in process, in which a defect has been found which necessitates additional work for repairs, or scrapping. This may happen either by reason of defects inherent in the material, such as blow-holes in castings, or may be the result of careless workmanship, errors in design, or defective machinery or tools.

HERE ARE THE SPECIAL ACCOUNTS TO CHARGE WITH THE  
COST OF SPOILED MATERIAL

In the case of inherent defects in materials, the management usually recovers the cost by billing it back to the source from which it was purchased. When this is not possible, a distinction should be made between defects in the material itself, and therefore beyond control, and those due to someone's error. The first should be charged to an account called "hidden defects" or "spoiled material," while the second should be charged to "reclamation of errors."

The charge for "reclamation of errors" is made up from the job cards and requisitions for the supplies necessary for repairs, which are charged up to that account, and from inspectors' orders to scrap materials spoiled beyond repair. Where the cause of the charge can be definitely determined, a charge is made directly against the offending department and may for purposes of discipline and control be brought home immediately to the offending individual. In other cases the charge becomes part of the general expense to be distributed over all departments.

This calls direct attention to the necessity and opportunity of improvement in departments and individuals, or of change



in the design or materials of the product. Systematic pursuit of this policy reduced the spoiled material account in one concern from \$300 a day to \$60 a day within a period of six months.

The amount of a royalty charge is taken directly from the vouchers. When the royalty is proportionate to the product, it is estimated each month from the production records and charged directly to the product. When it is an annual fixed charge, it is prorated monthly and charged to the department or the machine. Some manufacturers prefer to consider royalties, like interest, a deduction from gross profits, in which case they are provided for in the profit and loss account and do not enter into factory cost.

HOW TO TELL WHETHER OR NOT TO CHARGE TOOLS, PATTERNS, AND  
EXPERIMENTAL WORK TO DIRECT OR INDIRECT COST

Tools, patterns, and development work such as experimental models for new products, inasmuch as they are not sold like the product, are of course an indirect expense, of which the cost is ascertained in a way similar to that of repairs and alterations—that is, from job cards for labor and requisitions for materials, charged directly to the tool or pattern order and then charged to a particular job or order when possible; otherwise to departmental expense or to general expense to be distributed over departments.

There is an important distinction, however, to be borne in mind. Ordinary repairs and alterations do not add to the value of the plant and are therefore purely an indirect expense.

Expensive tools, patterns, and experimental work, on the other hand, do add something to the value of the plant, although, as will be shown later, they must be heavily depreciated. This being the case, it is important that the full value of tools, patterns, and models be ascertained. To do this it is necessary that they be fully charged with all items of indirect as well as direct expense involved in making them, just as

though they were part of the product to be sold. This is a clear case where "indirect on indirect" is properly chargeable.

For clerical convenience, it is advisable to symbolize these various items of indirect expense by some system of numbers or letters, or both, as described in a later chapter. The cost symbol indicating the nature of the charge and the order number, department number, or the symbol to which it is charged, appears on all vouchers for labor and materials chargeable as indirect expense, and these charges are then posted to monthly summary sheets for each job, order, or department, as the case may be. (See Forms 15 and 16.) All indirect expenses charged directly to departments are posted on the same sheet to each department and, afterwards, if desired, distributed over separate jobs or orders.

Daily records of expense are kept as indicated by Forms 14A-D (pages 56 and 57), 18A-D (pages 80 and 81), and 18E-F (pages 122 and 123). Forms 14A-B are the front side, and Forms 14C-D are the back side of the same sheet. Forms 18A-D and 18E-F are continuing forms, and cover all the details of Forms 14A-D, but, since they also give a record of private expenditures, they are intended for the use of principals only. So as to keep that portion of the private sheet that refers to selling, nearer that part of the text concerned with selling, these forms have been split up as indicated.

Monthly departmental summaries are made up as indicated by Form 16, while specific job summaries are compiled as indicated by Forms 15 and 36, the latter being a form used in a printing plant.



## V

### SHOULD INTEREST AND DEPRECIATION BE INCLUDED?

It is a debated question whether or not interest on the investment should be included in manufacturing cost. In some plants it is the practice to include interest on all capital invested, whether owned or borrowed by the concern. In others, only the interest on borrowed capital is included in the factory costs; while in still others, interest is not included in the factory costs at all, but is figured in the profit and loss statement as a part of the earnings which is divided between the owners of the capital, whether those owners are members of the concern or not.

The strongest argument for charging interest as part of the cost of production applies in the case of interest on borrowed capital. One manager says: "If borrowed capital is necessary to the conduct of the business, interest on it is as much a charge against production as is the cost of power. If interest on borrowed capital is included in the cost of production, it is logical also to include interest on capital owned. Otherwise, part of the product would be accidentally burdened with a charge from which other parts were free." Another argument in favor of this procedure is that by including interest in the cost of production, the selling price may in times of stress be reduced pretty close to actual cost and at the same time leave a fair margin of return on the capital.

## HOW TO FIND FACTORY COSTS

STORES SYMBOL <b>S</b>			CREDIT TO	
LOCATION	QUANTITY	KIND OF UNIT	COST PER UNIT	TOTAL VALUE
		POUNDS		
PLEASE CREDIT WORKED MATERIALS ORDER NO. _____				
WITH _____				
AND CHARGE BACK TO STORES				
NOTE: IF THIS IS A TRANSFER TO ANOTHER ORDER, THIS CREDIT MUST BE ACCOMPANIED BY A REGULAR STORES ISSUED AGAINST SUCH ORDER.				
STORES CREDITED			MONTH	DAY
			YEAR	

FORM 12

Sometimes it is possible to reclaim material which would be otherwise wasted on incidental manufacturing operations. It is debited to the storeroom, and when disposed of, the storeroom is credited.

				MONTH	DAY	YEAR
				Aug	28	1916
MR. <u>Anderson</u>						
I HAVE TODAY COUNTED THE FOLLOWING MATERIALS IN STORES AND HAVE CORRECTED THE TAGS AND BALANCE SHEETS WHERE NECESSARY						
SYMBOL	DESCRIPTION	QUANTITY			REMARKS	
		ACTUAL IN BIN	SHOWN ON TAG	SHOWN ON BALANCE SHEET		
E-1	#1 sockets	146	146	146	O.K.	
PRODUCTION MANAGER 		SIGNED <u>R. E. Rich</u> STORE CLERK SIGNED <u>L. B. Anderson</u> BALANCE CLERK				

FORM 13

The symbol and description are taken from balance sheets. If the balance sheet and bin tag agree, the account is correct. If they disagree, the balance sheet and bin tag are adjusted accordingly.



The argument against the inclusion of interest in the cost of production is strongest when applied to capital owned entirely by the concern. The owners of capital have an option whether they will invest it in other enterprises at the normal rate of interest—getting their return without further exertion or great risk on their part—or, on the other hand, put it into a manufacturing enterprise of which they undertake the management and the whole risk, and from which they hope to get a larger return than normal interest in the form of manufacturing profits. They have a right to do either but not to do both. If they decide to manufacture, their net profit should be in excess of the current rate of interest; otherwise it would be safer and easier to invest their capital at the normal rate.

WHY INTEREST SHOULD NOT BE CHARGED TO COST OF  
PRODUCTION

From this point of view, interest on borrowed capital is merely a share of the profits which has to be paid to the owner of the capital; and while it is a cost of doing business, it is not a cost of production and therefore should not be charged in the manufacturing cost.

While it seems to me that the preponderance of logic is in favor of excluding interest from the cost of production, it remains true that practice is about equally divided, as there are advantages to both methods. A third method suggested—charging interest on borrowed capital only to factory cost—has no sound logic, extensive practice, or substantial advantage in favor of it.

Where interest is charged to the cost of production, the total yearly interest charge is prorated monthly to departments or to machines as explained in a later chapter.

Depreciation is the most difficult and most elusive element of factory cost. It occurs gradually, is easily overlooked, and when its effects become manifest in the form of obvious wear and tear or actual breakdown, it appears, almost out of a clear sky, to be remedied by repairs. It involves a considerable

DATE	INVOICE NO.	PURCHASES	PLANT, ETC. ADDITIONS, RENEWALS AND SHOP EXPENSE						ORDER NO.	SUPPLIES OR PARTICULARS	STORES FOR MANUFACTURING			RENT, RATES AND TAXES
			MATERIAL		LABOR		E. C.	GENERAL			ELECTRICAL			
			GENERAL	ELECTRICAL	GENERAL	ELECTRICAL					SWITCHES, MOTORS, ETC.	INSULATION MATERIALS		
1														
10														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
40														
49														
50														
51														
52														

FORM 14A

*This detailed continuous analysis book is used in the office. In it is entered every type of expenditure incurred throughout the business, and which passes through the ordinary office*

	PLANT AND MACHINERY				SMALL TOOLS		SHOP FITTINGS		PATTERNS, DRAWINGS AND BLOCKS		OFFICE FITTINGS		BUNA
	ADDITIONS	RENEWALS	ATTENDANCE		ADDITIONS	RENEWALS	ADDITIONS	RENEWALS	ADDITIONS	RENEWALS	ADDITIONS	RENEWALS	
			GENERAL	ELECTRICAL									
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
40													
49													
50													
51													
52													

FORM 14C

*All the non-productive expenses are classified in special columns. Every week these are totalled and posted to a loose sheet of similar character (Forms 18 A-D, pages 70 to 81, and*



## 57

[illegible]

records. It may also be used for making analyses of invoices or other payments. Orders are carefully separated from the work done for the factory itself.

[illegible]

Forms E-F, pages 122 and 123) which covers all the details of Forms 14 A-D, but, since it also gives a record of private expenditures, it is intended for the use of principals only.





element of prophecy, judgment, guess and accident; and even when an earnest effort is made to take proper account of it, it must forever remain more or less of a good approximation. The element of depreciation alone is sufficient to keep cost accounting from becoming an exact science.

Depreciation occurs as the result of wear and tear due to active use, physical deterioration, neglect, inadequacy and obsolescence.

#### WHERE TO DRAW THE LINE BETWEEN MAINTENANCE AND DEPRECIATION

Ordinary wear and tear of buildings and equipment is largely compensated for by current repairs. When these repairs are just sufficient for the maintenance of the plant and equipment, they are charged as maintenance expense as described in a previous chapter. When repairs and alterations are on a sufficiently large scale to increase the value of the plant or equipment, they produce an addition to assets and are charged, therefore, as capital expenditures.

Depreciation, however, is only retarded and not stopped by repairs. A building may be made to last for centuries, but it will eventually fall into decay if continually used. A machine eventually gets to the point where it is cheaper to scrap it than to repair it. Depreciation, therefore, must be figured on plant and equipment separately from maintenance.

Many materials deteriorate more or less rapidly even when they are not in use. Perishable food products are an extreme example of this. Dyed cloths and yarns furnish another illustration.

Neglect is a phase of depreciation by wear and tear and comes about from improper or inadequate maintenance and repair. This mistaken policy apparently keeps down the current cost of production, thereby apparently adding to profits unless compensated for by an increased rate of depreciation. A certain company congratulated itself for years on its exceptional profits, only to find at the end of eight years that its

plant and equipment had gone to rack and ruin and that notwithstanding the fact that current repairs and maintenance had been neglected, no provision had been made for replacement. In other words, the profits were coming out of the capital originally invested in plant and equipment.

Plant and equipment may be outgrown by the increasing demands of the business and the point reached where additions are not so much in order as a new building and new machines of a different type. This accelerates the scrapping of the old building and equipment and must therefore be added as a further element of depreciation.

The progress of invention frequently necessitates the scrapping of one type of machine in favor of a new and radically improved type long before the former is worn out. This is a highly important factor in the electrical and printing industries where new inventions are announced almost daily.

Depreciation may be figured either by a periodical appraisal, or by an annual decrease of book value, by any one of several methods, or by a combination of both. The book depreciation usually has to be checked in the interests of accuracy by an occasional appraisal.

The original cost of plant and equipment being taken from the books, the value at any time may be determined by an expert appraisal. This is too difficult and intricate a subject to enter into in detail here, and one which it is beyond the scope of this book, which is written primarily for factory managers and not for those chiefly interested in making appraisals.

HERE IS A PLANT, REPLACEABLE AT \$12,000, WHICH WAS  
APPRAISED AT \$40,000

The best advice that I can give is that an expert appraiser be retained for the purpose, care being taken to be sure that the expert is an experienced appraiser and has a practical knowledge of the industry for which he is engaged. I have known an expert appraiser of art works to value the equip-



ment of a small bindery six years old at \$40,000, when it could have been replaced new for \$12,000.

There are three well-known methods of figuring depreciation of book values. All of these involve, first, the price or cost of the item in question; second, an annual rate of depreciation; third, the scrap value of the item.

In all cases the probable scrap value is deducted from the original cost. The balance is the amount which has to be wiped out year by year during the probable productive life of the item.

#### THREE WELL-KNOWN METHODS OF FIGURING DEPRECIATION WHICH ARE USUALLY USED

The three usual plans are the percentage on original cost plan, the percentage on diminishing value plan, and the sinking fund method.

By the first method—the percentage on original cost plan—the difference between the purchase price and the scrap value is divided by the number of years in the estimated productive life, and book value is depreciated each year by the amount of this quotient. For example, if a machine costs \$1,600, and is to be scrapped at the end of ten years at a probable price of \$400, the annual depreciation is at the rate of  $\frac{\$1,600 - \$400}{10}$  or \$1.20 a year.

This is the simplest, easiest, and most common method. It fails to take into account, however, the fact that depreciation is much more rapid during the early productive years than during the later years. A new machine loses more of its value during the first year of use than during the last.

To meet this objection, the percentage on diminishing value plan has been devised. By this plan, the depreciated value each year, is further depreciated by the same fixed percentage, this percentage taking into account the estimated productive life. In the example already given, this percentage would be about fifteen per cent. The depreciation would then be as follows:

First	Year, 15% of	\$1600.00 or	\$240.00 leaving a book value of	\$1360.00
Second	Year, 15% of	1360.00 or	204.00 leaving a book value of	1156.00
Third	Year, 15% of	1156.00 or	173.40 leaving a book value of	982.60
Fourth	Year, 15% of	982.60 or	147.39 leaving a book value of	835.21
Fifth	Year, 15% of	835.21 or	125.28 leaving a book value of	709.93
Sixth	Year, 15% of	709.93 or	106.49 leaving a book value of	603.44
Seventh	Year, 15% of	603.44 or	90.52 leaving a book value of	512.92
Eighth	Year, 15% of	512.92 or	76.94 leaving a book value of	435.98
Ninth	Year, 15% of	435.98 or	65.40 leaving a book value of	370.58
Tenth	Year, 15% of	370.58 or	55.59 leaving a book value of	314.99

This method is almost as easy to apply, and is more accurate, than the percentage on original cost method.

Both these methods are valuable where the depreciation fund is treated as a book asset and continues to be used in the business. It is the usual practice to provide for such a fund before declaring dividends or paying profits. It is not customary, however, to make an actual cash reserve, as this fund can be more usefully employed in the development of the business than in merely drawing bank interest.

#### USING THE SINKING FUND METHOD TO DETERMINE THE EXTENT TO WHICH ASSETS HAVE DEPRECIATED

There are instances, however, where it is desirable to have on hand at a definite time the exact amount necessary to replace the depreciated assets, as, for example, when a fixed time is set for the termination of any business, or where conflicting and contested interests may at any time require a liquidation. In these cases the third, or sinking fund method, is the best.

In the sinking fund method, each year an amount is set aside which, accumulated at compound interest, will in the aggregate produce an amount at the end of the estimated depreciation period, equal to the original investment. The methods of figuring this are quite complicated, but tables are published showing the amounts that have to be set aside at various rates of interest for various periods to secure a given total. If you will write to the publishers of this book—the A. W. Shaw Company, Wabash Avenue and Madison Street, Chicago, they will gladly inform you where you can purchase tables of this type.



With the aid of these tables the accountant's work is much simplified.

A fourth method, which it would be hard to justify logically, but which is nevertheless practical and easily worked, is that devised by Professor Cole of Harvard University. His object is to allow for the more rapid depreciation during the early years. He does this in the following way. Suppose the estimated life is five years and the difference between the purchase price and the scrap value is \$1,500. The total of the numbers representing the number of years of life, one, two, three, four and five, is fifteen. The depreciation will then be as follows:

First year	5/15 of \$1500.00 or \$500.	Fourth year	2/15 of 1500.00 or \$200.
Second year	4/15 of 1500.00 or 400.	Fifth year	1/15 of 1500.00 or 100.
Third year	3/15 of 1500.00 or 300.		

It is obvious that the different items of plant and equipment will depreciate at different rates. A concrete building will last longer than a wooden shack. Boilers will depreciate at a different rate from land, tools, or horses. The rates selected depend largely on the judgment and experience of the estimator and may vary with climatic conditions, operating conditions, and even types of management, all of which affect the probable life of each item.

HOW TO USE STANDARD RATES OF DEPRECIATION WHEN  
BASED ON NORMAL CONDITIONS

Nevertheless certain rates have become generally accepted as standard. With these standard rates based on normal conditions in mind, it should not be difficult to make such variations as are required by particular circumstances.

The only rate *not* to use is that which is dependent on the profits of the business. Profits may come and go but depreciation goes on forever. The policy which depreciates heavily during prosperous years and not at all during periods of depression is misleading and improvident. The rate of depreciation is an objective and impersonal fact inherent in all the physical conditions. It depends neither on the feelings of the

management, nor on profits, although profits may be seriously affected by the rate of depreciation.

The preliminary expenses of the organization and development of the company show no visible and permanent asset and should therefore be cancelled quickly, say in five years at the most. The same is generally true of the cost of good will when purchased.

WHAT TO DO WHEN PROPERTY APPRECIATES IN VALUE  
INSTEAD OF DEPRECIATING

In a growing community land does not depreciate in value. It may even appreciate rapidly. Conservative practice, however, takes no account of appreciation on the books until the property has become too valuable to use for manufacturing purposes. If land is depreciating, however, this depreciation should be duly noted. It had best be obtained by appraisal.

The deterioration of the buildings depends on the nature of the construction and the character of the industry. In rough trades, such as the manufacture of iron and steel, constant repairing and rebuilding is necessary. In machine shops, where there is heavy vibration, the rate of depreciation is also comparatively high; while in textile mills and printing plants, where the machines are placed on solid foundations, the rate may be very low. For a brick building of the first class, four per cent is about right; of the second class, three per cent, and of the third class, two or two and one-half per cent. Cheaper buildings of wood or iron should depreciate at higher rates ranging from five to ten per cent.

The rate of depreciation on machinery depends of course on its durability, which is affected by the severity of the work, the velocity, the overload capacity, the hours of work, renewal of wearing parts, cleaning and oiling, and the grade of labor employed. In addition the probability of obsolescence must be considered.

Steam engines and boilers are usually depreciated at five to seven and one-half per cent where proper attention is given





#### IT PAYS TO MAKE A MAN'S WORK INTERESTING

*Positions four, five and six in the manufacture of a freight car. There is a spirit of rivalry between the thirteen standardized positions on each construction track. The position behind is trying to feed cars to the next position faster than they can be received, while another position may be grumbling that it has finished and is being held up for work*

HOW TO FIND FACTORY COSTS

COST ASSEMBLY SHEET NO.											
ORDER NO.	QUANTITY	DESCRIPTION	PART NO.	LABOR			MATERIAL			EXPENSE	
											DIRECT

FORM 17

*This is typical of the sheets on which the costs are assembled. Each sheet is numbered. Space is provided for the date, order number, the quantity, the description, the number of the part, the*

	PERPETUAL		
	DESCRIPTION _____		
	QUANTITY	SYMBOL OR MACHINE NO.	DESCRIPTION AND MAKER'S NAME

FORM 10

*This sheet is used for all the machines of the same type, as, for instance, turret lathes. A symbol indicating the type is inserted in the upper right hand corner, such as "LE" for "engine lathe."*







#### AN EMPLOYEE'S "TOOL RELEASE"

*When a workman leaves some factories he reports to the paymaster, following a visit to the central tool room, where he turns in his complete equipment and quickly receives a "tool release," which is a printed check, numbered, showing that he has surrendered his tools and equipment. Without a "tool release" it is of course impossible to secure final pay from the paymaster*



to upkeep and repair. Dynamos, portable engines, motors, and electrical equipment could be figured at from ten to fifteen per cent, although the scrap value may be high and the total loss not so great as might be inferred from this high rate of depreciation. Ordinary types of machinery last from six or seven to fifteen years and should be depreciated accordingly.

Patterns, drawings, and sketches are in a very different category. When made for a specific job or order, they should be charged to that order at once as expense. When they are made for a stock product, their value depends on the probable duration and extent of their usefulness. Conservative practice depreciates them very rapidly.

Where the industry can afford it, it is desirable to charge off immediately to expense all small tools and equipment. In some cases, however, as in machine shops, the investment in high-speed steel may be so heavy as to add something permanently to the value of the plant. In this case it is desirable to charge fifty per cent of the investment in tools at once to indirect expense, carrying the other fifty per cent as an asset until scrapped, which is pretty apt to occur within a year or two.

An excellent Form is number 19, which lists on one sheet all the machines of the same general type as indicated by the symbol in the upper right hand corner. This form covers all of the facts necessary to take care of depreciation.

Form 20 covers also interest on the investment, cost of repairs, hours run (estimated and actual), and cost per hour, as well as the percentage of efficiency obtained by dividing the standard cost per hour by the actual cost per hour. If properly kept, this form gives a complete record of the comparative values of machines.

## VI

### CHARGING EACH UNIT WITH ITS PROPER SHARE

Having ascertained the amounts of the various items of indirect expense, there still remains the problem of charging each unit of product with its own proper share of the expense. This is as important as it is difficult, especially in a plant manufacturing a variety of products, in which there may be some risk of selling certain items for less than they really cost, and of loading others with a selling price which puts them at a disadvantage in a competitive market. It is only by charging each line with the share of the indirect expense which accurately and honestly belongs to it, that it is possible to act intelligently in the matter of prices, changes in design, and new developments in process and administration.

Not long ago a manufacturer decided to close out a certain line on the ground that it was a losing proposition. If this was so, it was a bad sign for the concern, so an investigation was started. It soon developed that the cost system in use apportioned the general expense in such a way that the department in question was burdened with several times the amount of expense it should have borne. The apparent loss of \$15,000 shown on the books proved to be a loss of \$800. As the history of the department showed that it was useful to the full line manufactured, it was decided to retain it. To-day the department shows fair signs of making a profit. Its advan-



tages would have been lost entirely had the old and defective cost system been followed.

Of course it is possible to spend more in the effort to approximate absolute accuracy very closely than the result is worth. The all-important point is to be sure that every item of expense, without exception, is in some way charged to the total production sold. There may be instances where, if this is done, it is comparatively unimportant whether or not each item is charged with its absolutely exact share. This is true, for instance, where there is a wide margin of profit on all lines, or where the product is fairly uniform in price and direct cost. In this latter case the margin between the direct cost and the selling price is practically the same on all items, and a burden insufficient in one instance to cover the entire indirect cost is counterbalanced by the overcharge in another.

ADAPTING DISTRIBUTION TO THE PURPOSES WHICH  
EXACTLY SUIT YOUR NEEDS

In the great majority of cases, however, it pays to go to a reasonable expense to secure a sane degree of accuracy in the apportionment of indirect expense. The interpretation of this term "reasonable" must be left to the trained and experienced judgment of the responsible authorities.

The apportionment of indirect expense is technically known as distribution. This distribution may be made to departments, to functions, or to product, depending on the purpose for which it is to be used.

In every case, distribution—here called final distribution—must be made to the product, as it is through the sale of the product that the indirect expense is eventually recovered.

It is important for some purposes to make what may be called an intermediate distribution to departments for the purpose of controlling the indirect expenditure of departments or for the purpose of comparing this expenditure with a corresponding expenditure at other periods or in similar departments or plants; or even to specific functions which may not

## HOW TO FIND FACTORY COSTS

Shop No. 363		Description 40227 Builder		Price 1323.00 Date 12-31-15							
Year	INVESTMENT			INTEREST			DEPRECIATION (on machine alone)			TOTAL INTEREST AND DEPRECIATION	
	Inventory	Auxiliary Equipment	Total	Rate	Amount Year Week		Rate	Amount Year Week		Year Week	
1914	\$925.00	\$2775.00	\$3700.00	6%	222.00	427	10%	11.50	1.78	\$314.50	6.05
(1) Month	(2) Interest and Depreciation Expense	REPAIRS			(6) Grand Total	Hours Run		Cost Per Hour		(11) Cost Efficiency %	
		(3) Labor	(4) Material	(5) Total		(7) Standard	(8) Actual	(9) Standard	(10) Actual		
Jan.	\$0.185				\$0.185	265	238	0.114	0.126	91	
Feb.	24.22				24.220	185	113	0.191	0.214	61	
Mar.	24.22				24.220	220	92	0.110	0.264	42	
Apr.	24.22	7.16	.02	7.18	31.400	205	126	0.153	0.249	63	
May	\$0.185	.16		.16	\$0.345	265	181	0.114	0.167	67	
June	24.22				24.220	280	184	0.110	0.182	84	
July	24.22				24.220	210	171	0.116	0.141	83	
Aug.	\$0.185				\$0.185	270	237	0.112	0.127	88	
Sept.	24.22	34		34	24.560	210	194	0.117	0.127	92	
Oct.	\$0.185				\$0.185	275	247	0.110	0.122	90	
Nov.	24.22	15.11	.05	15.16	39.380	210	225	0.187	0.177	103	
Dec.	24.22				24.220	210	200	0.116	0.131	96	
Total	314.500	22.77	.07	22.84	337.340	2745	2208	0.124*	0.162*	80*	
					(6)+(5)			(6)÷(7)	(6)÷(8)	(9)÷(10)	
								* average figure			

FORM 20

On this card is recorded the performance of every machine in use. A glance indicates whether the repair charges are too high, and enables the manager to put his finger on the weak spot.

DAILY TIME CARD					
WORKMAN'S NO. 206		DATE Aug 28 1916			
NO. 402		RATE .01			
ORDER NO.	NO. PIECES	OPERATION	NO. HOURS	AMOUNT	PIECEWORK RATE
33	326	Shaping	7	326	01

FORM 21

On this slip the workman tells what he has worked on during the day. It is filled out just before quitting at noon and at night and handed to the department foreman.



necessarily be departmentalized, as, for example, supervision, inspection, maintenance, internal and yard transportation, and the like.

It is often worth while to get detailed costs on a function for a short period in order to tune up the function in question and then drop it for another. For example, close attention to the cost of moving materials, carried on over a period of four weeks, revealed methods which reduced this cost in one plant by \$30 a day. Then separate costs were secured for a similar period on inspection with like results. Cost systems should be so arranged that total costs of this kind may be had at any time desired, but without necessarily keeping then separately all the time.

THIS IS THE ONLY ACCURATE WAY TO CHARGE  
INDIRECT EXPENSE OF MATERIALS

If materials constituting indirect expense are issued on requisition and indirect labor performed on job cards, as described in previous chapters, the intermediate distribution to departments or functions is made very simple by posting the amounts of these requisitions and job cards to the accounts of the departments or functions to which they were originally charged. This is the best and only accurate way to handle such expenses as may be charged at the time they are incurred directly to departments or functions.

There still may remain certain administrative charges which have to be distributed by estimate over departments, such as the salary of the general manager. The share of such an expense may be apportioned to the direct payroll of the department, or to the indirect payroll, or to both, and in most cases it is immaterial which method is used, provided only that it is easy to handle and fully accounts for every item of expense chargeable to the department.

There are many methods of closing indirect expense finally into the product. No one of these methods is absolutely accurate; almost every one of them has its advantages over the

others under certain circumstances; and in almost any plant made up of several departments, it may be desirable to use several of these methods at once, depending on the nature of the work in each department. Here again the selection of the method must be governed by the intelligence and judgment of the responsible authority, guided by the conditions of the case, the degree of accuracy sought, and the purpose for which the distribution is made.

WHAT FINALLY BECOMES OF  
INDIRECT EXPENSE

The more commonly used methods are the following: first, by estimated percentages revised by annual or occasional tests; second, by direct wages; third, by direct labor hours; fourth, by the total cost of direct wages and materials; fifth, by machine hours; sixth, by machine hour rates; seventh, by simple division. There are still other methods, such as distribution by the cost of materials, but they are of such limited and specialized application as to fall outside the scope of this book.

By the method of estimated percentages, the total indirect expense for the year is reduced to a percentage either of direct labor or of the list price. This percentage is then applied to each unit of product during the succeeding year or until it is revised.

This is perhaps the simplest and easiest method.

For example, if the total direct payroll was \$100,000, and the total indirect expense \$135,000, 135% should be added to the direct labor cost of each item as that item's share of the indirect expense. It should be remembered, however, that this method is usually the least exact and is accurate only when all the items of product go through practically the same procedure, involving the same relative proportions of hand labor, machine labor, transportation and supervision. If one line of product is made chiefly by hand labor, under this method it will be overcharged with costs belonging properly only to machine labor,



while the machine-made items will be charged with less than their proper share of expense.

I saw a good example of this in a factory making electrical specialties, where an estimated percentage of 100% on labor had been used for a number of years. The factory had changed over from the assembling of finished parts purchased outside, to the detailed manufacture of all parts. The introduction of a large amount of machinery not before used had resulted in a considerable increase in the ratio of expense, but the old 100% figure was still used. It was not until serious loss began to develop along certain lines that the investigation was made. This investigation showed at once that the expense ratio should have been at least 150%, and using this figure as a tentative basis, the factory worked out of its difficulties.

In any case, where this method is used, any overcharge or undercharge becoming apparent at the end of the year must be absorbed into profit and loss, or in some instances carried over to the succeeding year through a readjustment of the rate. Whenever there is a radical change in the methods of manufacture or administration, a revision of the rate is called for. Except in very rare instances, the rate should be overhauled once a year and, in many cases, oftener. If conditions are such that frequent revision is necessary, the advantages of simplicity and convenience are thereby overcome and it is better to use one of the other methods.

HERE IS AN EXAMPLE OF THE DIRECT WAGES METHOD  
OF CHARGING INDIRECT EXPENSE

In the direct wages method, the total indirect expense for the month is distributed over all the product made during the month in proportion to the cost of the direct labor. For example, if the total indirect cost is \$10,000, the total direct payroll \$10,000, and job "A" cost \$200 in direct labor, the job will be charged with \$200 of the indirect expense.

If there is much variation in the grade of labor used, this method throws the bulk of the burden on to the jobs requiring

the highest-priced direct labor. This may lead to injustice, as it is usually the case that the highest-priced labor requires the least supervision and produces the least waste.

Where machinery is used, it also happens frequently that expensive machinery involving a heavy indirect cost may be operated by low-grade help. This direct wages method would charge high-grade hand operators with most of the expense properly chargeable to the machine operations, being to this extent highly misleading. In short, it is safe to use this method only where all products go through practically the same operations, or where there is only a slight variation in the cost of direct labor throughout the plant or department.

By the direct labor hours method the total monthly indirect expense is apportioned to jobs or orders in proportion to the number of hours of direct labor spent on each job regardless of the cost of that labor. For example, if the indirect expense is \$10,000, and the direct labor 15,000 hours, the job which consumed 15 hours labor will be charged with one one-thousandth of the expense, or ten dollars.

ONE RESULT OF USING THE DIRECT LABOR HOURS METHOD WITHOUT  
ALLOWING FOR DIFFERENCES IN COST OF LABOR

This plan overcomes to some extent the objection to the direct wages method based on differences in the cost of labor. By this method a more efficient operator, requiring less power, light, supervision, and the like, is charged with less indirect expense than his slower fellow workman. It is still open, however, to the objection that the man without an expensive machine is charged the same proportion of expense as the operator of the most costly equipment, which may be misleading. This objection is overcome of course where the equipment of the department or the plant is fairly uniform in cost per operator, and in such cases the method may be safely used.

The total cost of direct wages and materials method is an attempt to reduce the errors inherent in the other methods already described by spreading them over a wider range in the hope that



one will neutralize another. For example, if the indirect expense for the month is \$10,000, the total direct wages and materials \$20,000, and the direct wages and materials on a given job \$400, the indirect expense for that job is one fiftieth of \$10,000, or \$200.

While there is no particularly logical justification for it, there are instances where no great accuracy is required, in which it may work with fair success, as, for example, where the products and processes are fairly uniform, or where the absence of machine expense on one type of product is counterbalanced by an unusually heavy material expense either for handling or for waste. This is a risky method to use and should be subjected to revision periodically, or on the occasion of any considerable change in product or methods.

THIS PLAN WORKS WELL WHERE EACH OPERATOR  
TENDS MORE THAN ONE MACHINE

The machine hours' method distributes indirect expense over jobs in proportion to the number of hours of machine time they have occupied and is figured in exactly the same way as the direct labor hours' plan. It is applicable to departments where most of the machines are tended by more than one operator or where each operator attends more than one machine.

In such cases it is more convenient to figure indirect expense on the basis of the machine time than on that of labor time. The method is open to the same objection, however, of a possibly wide variation between the costs of different machine operations. Maintenance, power, interest, and other charges may be light on a simple bench treated as a machine, and very heavy on a complex and expensive press or steam hammer. Only where the types of machines involved are fairly uniform in cost may this method be used with safety.

The machine hour rate differs from the machine hours method in that the former attempts to charge each machine with all the expenses specifically chargeable to it, such as interest, depreciation, taxes, rent, power, and the like, as well as its

appropriate share of general expense, and reduces the entire account to a rate per hour to be charged against all work going through each machine. This is the most elaborate, and, when properly worked, most accurate plan of distribution and will be discussed at length in the next chapter.

The methods thus far described are applicable mainly to industries manufacturing a variety of products, involving different costs of product, and where it may be desirable to know as accurately as possible the cost of each item, order, job or line. These methods are not necessary in an industry making but one line at a uniform cost, or in a concern working on a tonnage basis and putting all its product through practically the same operations.

In both these instances, the simplest method, and one sufficiently good for practical purposes, is to divide the total indirect expense by the total number of units of product, whether this unit be an item of product, such as a flower pot or a twist drill; or a unit of weight, such as a ton of steel, or iron, or sugar; or a unit of length or area, such as a yard of yarn or cloth or foot of lumber.

**YOU CAN EASILY CHECK THE ACCURACY OF YOUR MACHINE HOUR RATES  
BY THIS VERY SIMPLE TEST**

Rates once set in this way may easily be checked by a test. They should be so checked at least annually, and on the occasion of any considerable change in manufacturing or administrative methods.

It is sometimes a question how much reliance should be placed on rates established for some more or less distant period, such as the preceding five years, year, or month, and how far the management is justified in incurring the additional expense necessary to keep its rates of distribution strictly up to date. This again is a matter for the judgment of the authorities.

Where business conditions, including the design and quality of the product, the labor conditions, processes, methods of administration, and the market, vary but little from year to



year, rates once established may be relied on subject only to periodical or occasional checking. These conditions, however, are apt to characterize only the stagnant business.

The more typical growing business, in an active and rapidly changing market which necessitates frequent revisions of product and methods of manufacture and administration, can not safely trust to established rates of distribution without checking them so frequently that the cost of revision is apt to exceed the cost of a system sufficiently complete, responsive, and elastic to supply accurate information right up to the minute—that is to say, up to the last month or, at the best, the last week. In fact, sound judgment may approve a reliance on established rates during periods of comparative quiet and the temporary tightening-up of the cost system during periods of comparatively rapid change, especially in the small business which can not afford to maintain permanently a staff of cost keepers.

A cost system serves, among other objects, the purpose of insurance against disastrous errors. The value of the insurance is obviously dependent on the degree of risk and the amount of funds available, and each manager must settle this question for himself.

**THIS MANUFACTURER DOUBLED THE EFFECTIVENESS OF HIS WORKMEN  
BY INSTALLING A COMPLETE COST SYSTEM**

An interesting example of a cost system designed for a special purpose, which adopts the unusual procedure of charging all indirect expense to rush jobs, was described in **SYSTEM** as follows:

"A manufacturer of machinery found his cost system too simple to deal with a number of problems, which ought to be accurately solved. The business has few competitors in its field, and gets an excellent price for its goods because of the fact that the product is well protected by patents and has a fairly steady market.

"Because profits were reasonably sure and fairly large, there had never been any systematic attempt on the part of the managers, foremen or other supervising men to get the most out of the plant, the machines or the workmen. The elemental cost system first used merely gave a rough idea of the general cost of the finished machines; there was little or no

## HOW TO FIND FACTORY COSTS

[illegible]

FORM 18A

*These four sections of a sheet, together with the sections 18E-F (pages 122 and 123), make up a single detailed analysis sheet showing the weekly totals of the analysis book (Forms 14A-D.*

[illegible]

FORM 18C

*This form enables the higher executives to keep close watch on the detailed expenditure. The fifty-two spaces provide a complete annual record of the business, which can be totalled for any*





attempt made to determine specific costs on parts, while the costs on the finished machines, ready to ship, was in the nature of an estimate.

"With the installation of a new system, it was found that the efficiency of the foremen and the workmen was raised greatly—in some cases doubled. This came about because it is possible, under the new system, to route an accurate cost card on any job at any time. Thus, it is possible to determine exactly, from the cost data shown on this card, what rate of speed the men are making, what materials are being used, and how a certain job compares with any other job, done either the same day or on any day subsequent to the time of the installation of the system.

"This system, as now in operation, shows:

- (1) The exact cost on rush jobs
- (2) The average cost on all small parts
- (3) Detailed and accurate factory expense cost accounts, month by month
- (4) Accurate and detailed profit and loss statement for each month
- (5) Estimated cost on completed machines. This estimate is drawn from the daily record of the cost of type machines, by which is designated a machine that is duplicated from year to year

"This furnishes a cost-keeping system which is somewhat different from the cost-keeping systems ordinarily used. The main difference is that ordinary systems usually do one of two things: (1) Merely scratch the surface of cost expenditures, failing to determine to a reasonable certainty the actual cost of the product, but rather securing an "estimate;" or (2) attempt to do something that may be impracticable, except at too great a cost—that is, secure exact costs on every machine that is put out.

"This system is thorough enough to furnish practical data, for it lists all the costs that are necessary to a knowledge of what the profits are. And it does this in the face of the fact that the system does not secure costs on all completed machines, but merely takes a type machine for the day, week or month, and, after determining that the costs on that machine are running uniformly, it makes from these tests a standard cost for the machine. On the other hand, where parts are made continuously in bulk, the cost tests are constant.

**HERE IS HOW ONE MAN HANDLES RUSH JOBS ACCURATELY —  
AND IT'S QUITE SIMPLE**

"Another important point of this system is the method of application of factory expense. Factory expense is usually apportioned uniformly over all items manufactured. In this system it has been found most satisfactory to make rush jobs—of which there are a large number—bear the overhead of ordinary routine work. It has been found that rush jobs disorganize the regular routine of the works, and that the interruption of the customary routing and assembling alone is enough to require the double application of burden. This plan is particularly feasible in this particular line, as rush jobs are always billed to the customer at one and one-half times the regular selling schedule. The theory of rush jobs is, in fact, that they are put through merely to protect the house.

"There are two forms used in computing labor time. The first of these, shown in Form 21, is a slip which the workman fills out showing the



disposition of his time during the day. He is required to see that these slips are filled out ten minutes before quitting time at noon and at night. While simple, these slips have been found to answer the purpose.

"On rush jobs, the workmen's time slips, on a bright red stock, follow the job as it passes through the regular routing. On this slip the workman jots down the time he spends on the job, turning it over to the next workman, who puts down his beginning time. The slip follows the job through the regular routine and, when summarized, furnishes automatically the total time spent upon it.

"The foreman summarizes his workmen's reports on the sheets shown in Forms 22 and 23. Slips turned in by the average workman must be verified, and the time distributed and summarized. This work is made the duty of the department foremen. Productive labor is listed on one side of the sheet (Form 22) the reverse side (Form 23) bears an itemization of non-productive expense, such as unloading material, and so on.

#### HOW FACTORY EXPENSE IS COMPUTED AND SEPARATED INTO DIVISIONS

"Forms 24 and 25 show the cost sheet and comparative cost sheet. These cost sheets are used particularly on two kinds of jobs; bulk jobs, in which small parts are made in a uniform manner day in and day out; type jobs, in which the type machines are made up—the cost sheet following on them in about three cases out of ten. By allowing for a variation of three and one-half per cent in the cost of production of type machines, it has been found that there is no difficulty resulting from the finding of costs merely on a certain percentage of machines instead of on every one, as this percentage can be raised at any time.

"Forms 26 and 27 show the factory expense account sheet and the profit and loss statement sheet. These are computed monthly. The factory expense account sheet divides expense into four groups, the first embracing taxes, insurance and salaries. The next division embraces the expense of construction and direction, including forge, manufacturing, dies, tools, assembling, grinding, hardening and finishing expense. Besides these, the expense of unloading materials, sweeping and oiling, handling stock, running errands, correcting mistakes, factory supplies, reserve for repairing tools and for accidents make inspection and direction expense.

"The division under power, light and heat includes the expense of engineer and tools, unloading material and other supplies. Shipping room expense includes the expense of labor, supplies and teaming. The repair account expense includes building and construction, power plant (not machinery), including motors, tools, transmission and belting, pipes and fittings, stock fixtures, and electric lights, office fixtures, dies and patterns.

"The profit and loss statement, issued monthly, shows administrative expense, traveling expense and profits on various accounts. This method of figuring profits on individual accounts is one which tends to localize profits throughout the works, and, in case a certain account fails to show a profit, it means that either that department is running at too great an expense or else there is some leak or loss which needs investigation.

## VII

### THE MACHINE HOUR RATE PLAN

The general impression of the machine hour rate plan prevalent among the managers of most plants is that it is a new, highly mysterious and complicated invention of cost accounting experts, intended mainly to create a demand for their services. They are made to feel that, whatever it is, it is something they ought to have and that on account of its complexity, they can only get it by hiring an expert "to put it in" for them.

The truth is that for some kinds of industry, especially those in which it is highly important that an accurate cost of each item of a varied list of products, and even each part, should be quickly available, the machine hour rate plan is the best, for reasons which will appear as its operation is described. There are many types of industry, however, in which the degree of speed and accuracy which this method attains is unnecessary, and therefore the method itself disproportionately expensive. For the ordinary run of businesses, a combination of the methods described in the preceding chapter is sufficiently accurate and easier to install and operate.

The current impression of the complexity and the difficulty of this method is somewhat exaggerated. There are really but two difficulties. The first is the difficulty of getting into the machine hour rate every possible item of factory cost. These are so numerous, and sometimes elusive, that it requires extreme



care to round them all up. If a single one is omitted, it must, when found, be taken care of by an adjustment. In accounting, every adjustment is a recognition of an error, and an accumulation of errors may be fatal to a system.

The second difficulty concerns the disposition to be made of the cost of idle time—that is, the time during which the machines, through whose predetermined hours of operation all costs are taken care of, are unexpectedly standing idle. There are several methods, however, of handling this problem, none of which is very mysterious. Once the machine hour rate is determined, its application to the finding of current costs is, if anything, simpler than the operation of the other methods; and if due attention is given to the careful determination of the rate, and to the handling of idle time, a reasonable degree of accuracy may be reached in the average plant without the assistance of consulting experts.

THIS PLAN IS EASIER TO APPLY THAN SOME OTHER METHODS  
YOU MAY KNOW ABOUT

The essence of the machine hour rate plan is the collection of all factory indirect expense into an hourly charge against the product going through each machine, including in the term "machine" any bench or work-place, as well as the equipment usually given that name. Each machine (or, in a few instances, each group of machines) is treated as a "production center," for the use of which the product pays a rent as it goes through the production center, the rent depending on the number of hours it occupies the center—that is to say, if the machine hour rate or rent of machine "A" is one dollar and twenty cents, and of machine "B," two dollars, and a certain order "X" is on machine "A" three hours, and on machine "B" one hour and a half, "X" will have accumulated three dollars and sixty cents indirect expense from "A," and three dollars from "B." By the time "X" is finished, it will have "rubbed off" from each machine its total share of the factory expense, which will have





been easily ascertained from the time cards showing the elapsed time of this order at each machine.

The hour rate, or rent of each production center, is made up of three elements: first, the share of the building cost chargeable to the space occupied by the production center; second, the cost attributable to the nature of the production center itself, as, for instance, the cost of maintenance, power, and the like, for the machine; and, third, the share of general administrative expense which must in some way be apportioned to each production center.

CHARGING THE PRODUCTION CENTER WITH ITS FAIR SHARE OF  
STRICTLY FACTORY EXPENSE

Each production center occupies a certain amount of space for which it must be charged with its proportionate share of the cost of the entire building, including rent, taxes, insurance, depreciation, fire protection, janitor service, maintenance and interest on the investment, if interest is included in factory cost and is not already covered in rent. These charges can be apportioned in either of two ways.

Suppose the entire plant area is ten thousand square feet, of which six thousand feet are used for strictly manufacturing purposes and four thousand feet for auxiliary and administrative purposes, such as storerooms and general offices. Then a production center occupying one hundred square feet may be charged with one hundred ten-thousandths of the entire building cost as its share of strictly factory expense, and the store-rooms and administrative departments charged similarly with their respective shares.

In this case, the share of plant expense charged directly to administrative and auxiliary departments must be afterward charged to the production center along with other administrative expense, as explained in a later paragraph. This method has the advantage of giving an accurate picture of the real cost of administrative departments.

By the other method, the share of building expense chargeable to the production center will be one hundred six-thousandths of the entire plant cost, thus apportioning at once to production centers their entire share of this cost. The only advantage of this method is a slightly greater simplicity in the establishment of the hourly rate. On the whole the first method is preferable.

The building expenses enumerated in the preceding paragraph are practically uniform for every part of the plant. Other expenses incident to the building may vary with different departments and floors. This includes such items as general lighting, which will be less in those departments having the better natural lighting; heat, ventilation, and transportation equipment fixtures, such as traveling cranes and elevators.

The total departmental expense for such items as these should be distributed to the machines in the departments served. Heat, general lighting, and ventilation are generally charged in proportion to the area occupied by the production center, and usually this same basis is also good for the cost of fixed transportation equipment, although, where greater refinement is desired, such equipment may be charged exclusively to the machines served by it.

#### MACHINE COST AS AN ELEMENT IN THE MACHINE HOURLY RATE

The specific machine cost, as an element of the machine hour rate, includes those expenses which arise out of, and are directly attributable to, the production center, machine, or work-place itself. This comprises charges on the investment, such as interest and royalties (when these are included in factory cost), taxes, insurance and depreciation. In addition there are the charges incidental to operating the machine, including power and special lighting, determined by measurement; supplies, taken from requisitions on stores; and maintenance, including cleaning and oiling, taken from purchase orders for parts or work secured outside, and from requisitions



for materials and job cards for work done by the permanent force. The annual investment charges are easily calculated from the purchase price of the machine, while the operating charges are the subject of estimate checked by experience.

TWO GOOD METHODS OF DISTRIBUTING THE  
ADMINISTRATIVE EXPENSE

The administrative cost factor in the machine hour rate includes the cost of administration and the auxiliary expense incidental to running the factory, and covers the salaries of administrative officers, foremen, storekeepers, move-men, truckers, inspectors, accountants, clerks, and the like. To these figures should also be added the cost of supplies incidental to the work of these men, of equipment used by them, and of plant occupied (where this has not already been included in the rent charge of each production center as above described). The total or actual estimated annual charge for these items may be distributed equally over each production center hour, or may be apportioned in the ratio which the other indirect expense (that is, building and operating expense) per production center bears to the total of such indirect expense.

By the first method, if the total productive machine hours are 100,000, and the total productive hours of production center "A" are 2,000, "A" will bear one-fiftieth of the total administrative expense. By the second method, if the total building and operating expense of all production centers is \$100,000, and the building and operating expense of production center "A" is \$2,000, while the total administrative expense is \$25,000, "A" will bear one-fiftieth of \$25,000, or \$500, as its share of the administrative expense. One of these methods is as good as the other.

The best way to get all these factors together is to list the machines and production centers on a form which contains details that enter into the machine hour rate. Such a form is necessarily large, but not necessarily complicated. A sug-

gestion for a form of this sort is given in Form 51 (page 92). It can be modified to suit special requirements.

All expenses, including those for building, administration and operation having been taken into account and charged in some way to each production center, we have the total which represents the annual charge of each production center against the production going through it. This annual operating rent, if it may be so termed, is then divided by the estimated number of hours that each production center will be engaged in actual production, in order to determine the hourly rate—that is to say, if the total annual charge against production center “A” is \$1,000, and experience and estimate lead to the conclusion that “A” will be productively occupied for 2,000 hours during the year, the hourly rate will be  $\frac{\$1,000}{2,000}$ , or fifty cents.

This estimate of 2,000 hours automatically distributes the cost of what might be termed the normal idle time of the machine—that is, the rest of the 8,760 hours of the year.

The time occupied by each unit, lot, or order going through each production center is derived from daily or individual job cards. This elapsed time, multiplied by the hour rate, gives the indirect cost per operation, and the total of these costs constitutes the total indirect expense chargeable to the unit, piece, lot, order, or job—with one exception; namely, the cost of idle time.

HERE IS ANOTHER ITEM WHICH IS SOMETIMES OVERLOOKED  
IN COMPUTING THE HOUR RATE

Before proceeding to discuss the idle time factor, it may be well to mention another item which it is advisable in some cases to include in the hourly rate—that is to say, the labor cost of machine operators and attendants. While this is of course a direct cost, and may be determined from job cards as explained in a previous chapter, there are occasions, as where a group of machines is attended by a single operator, or where one machine is attended by an operator and several helpers, when it is more



convenient to divide wages between machines and account for them in the hourly rate. Where wages are not subject to variation in rate, as by bonus or premium, this is often the easiest way to handle them.

Not infrequently it is necessary to include in the factory equipment certain machines which will be used only occasionally on special jobs involving unusual factors of size or weight. Although the normal estimated productive hours of most machines may be twenty-four hundred a year, an exceptional machine of this type may be normally worked only one hundred hours, and yet it has to be kept on hand for the few jobs which need it. The total expense chargeable to this special machine, distributed over one hundred hours instead of twenty-four hundred, gives an abnormally high rate per hour.

SHALL IDLE TIME BE CHARGED AGAINST SPECIAL JOBS OR AGAINST  
THE ENTIRE PLANT?

Whether the jobs going through this machine shall be charged this abnormally high rate, or whether the cost of the twenty-three hundred hours of idle time shall be charged against the entire plant as a cost of doing business, is a question of policy to be decided by the management, having in mind the effect of either policy on the cost of each line of product involved.

The idle time just discussed is a definite predetermined quantity, which easily can be taken into account in making the machine hour rate. There is another variety of idle time arising out of the fluctuations in the rate of production that can not be predicted. While the normal production hours may be two hundred a month at production center "A," the production record of "A" may show that only one hundred and eighty hours of "A's" time were occupied. In this case the estimated monthly cost rental of "A" will not have been paid by the production going through this center. It will be twenty hours short.





There are two ways of handling this idle time shortage. The deficit may be made up, first, by the addition of a certain percentage to the cost of all work for the month in question, this percentage being determined and applied after the expiration of the month. This method makes idle time distinctively a factory cost.

A SECOND GOOD METHOD FOR  
CHARGING IDLE TIME

Under the second method, the cost of idle time is considered a charge against the business as a whole and is handled through the gain and loss statement, on the theory that not the factory, but business conditions in general, or the sales department specifically, are responsible for the shortage. The second method has several advantages over the first, in that it permits of accurate comparisons of factory cost, uninfluenced by fluctuations in market conditions, and also that it brings forcibly to the attention of the management the importance of keeping plant and equipment occupied at the full or normal capacity.

In either case the amount of the shortage is determined by comparing the total machine hour charges for the month, as taken from the job cards, with the total predetermined charge, as taken from the original estimates. The balance, if any, is the cost of idle time. The total accounted-for cost is then divided by this balance, giving a percentage by which the accounted-for cost of each production center must be raised in order to absorb the entire actual cost for the month.

For example, suppose the monthly estimated charge is \$10,000. Of this cost, \$8,000 are accounted for by job cards, or, in other words, the plant has been running at four-fifths of its capacity. The balance of \$2,000 is the cost of unemployed equipment.

If this is to be made a charge against production, it must be distributed over the orders which did go through. Dividing the total accounted-for cost (\$8,000) by the cost of idle time (\$2,000), gives a factor of twenty-five per cent, which is the

FACTORY EXPENSE ACCOUNTS FOR MONTH OF _____										191	
NAME OF ACCOUNT		AMOUNT				NAME OF ACCOUNT		AMOUNT			
TAXES FOR MONTH						BALANCE					
INSURANCE FOR MONTH											
SALARIES, OFFICERS											
* FOREMAN											
* WATCHMAN											
INSPECTION AND DIRECTION											
FORGE	DEPT.					PRODUCTIVE LABOR FOR MONTH					
MANUFACTURING	*										
DR	*										
TOOL	*										
ASSEMBLING	*										
GRINDING, HARDENING AND											
FINISHING	*										
UNLOADING MATERIAL											
SWEEPING AND OILING											
HANDLING STOCK											
RUNNING ERRANDS											
CORRECTING MISTAKES											
FACTORY SUPPLIES											
RESERVE FUND FOR REPLACING MGS AND TOOLS											
* * * ACCIDENTS											
POWER, LIGHT AND HEAT											
ENGINEER											
FUEL											
UNLOADING FUEL											
OTHER SUPPLIES											
SHIPPING ROOM											
LABOR											
SUPPLIES											
TEAMING											
REPAIR ACCOUNTS											
BUILDINGS AND CONST.											
POWER PLANT MACHINERY											
MACHINERY F & F AND MOTORS											
TOOLS AND EFFECTS											
TRANSMISSION AND BELTING											
PIPE AND FITTINGS											
DRIP PICTURES AND ELECTRIC LIGHT											
OFFICE FIXTURES											
UES AND PATTERNS											
TOTAL											

FORM 26

Here is a typical factory expense sheet for grouping the detailed factory expenses under their appropriate headings. The percentages are also figured on this sheet, and the totals computed.



amount by which the cost of each job, as shown by the job cards, must be raised in order to absorb the entire cost. If the total machine hour cost of job "X," as shown by the job cards, is \$300, twenty-five per cent, or \$75, must be added to this figure, thus making the adjusted indirect cost \$375. The same process applied to all jobs during the month results in absorbing the entire indirect expense as originally estimated.

Form 28 is a convenient means for recording the total estimated hours and the total actual hours, and for making necessary adjustments based on experience.

WHY USING PERCENTAGE FIGURES AS GUIDES TO  
SALES HELPS OUT

It will be noted that the idle time percentage figure is an index to one aspect of the effectiveness of the concern; namely, its success in keeping the entire plant and equipment occupied full time. This may serve to a certain extent as a guide to the sales or order departments.

It must be said, however, that this blanket percentage does not give sufficiently definite information to be of great value, for it may cover the fact that, while certain machines or groups of machines are running under capacity, others are working overtime. What the management really wants to know is what machines are running under capacity, so that stock orders or sales may be controlled to take up the slack where the slack exists.

It is possible to get a percentage of idle time from a comparison of the predetermined cost with the actual job card cost of each production center. This adds considerably to the complexity of the method, and the result to be obtained from it can be much better secured in another way—from production records for each production center. Such records show the estimated operating time for each month and against this the actual operating time, as shown by the job cards, and the calculated percentage of time efficiency. Such a form is illustrated by Form 20.

## VIII

### HOW TO HANDLE THE COST OF SELLING

From one point of view, the manufacturer is in business not primarily to produce goods but to produce profits. Profits are not made until the product is sold; and from this point of view the cost of selling is a part of the cost of production, at least of the production of profits.

On the other hand, there is good reason for the current practice of considering selling costs quite apart from factory cost. Factory cost, with the exception of the part known as general administrative expense, has a close, real, and traceable connection with the manufacture of the product, and varies just about as the actual conditions vary. There is, however, no necessary connection whatever between the cost of selling an article and the conditions under which it is manufactured. Unless selling costs, therefore, are kept separate from factory cost, the value of costs as a guide to production is pretty apt to be lost.

This practical line of reasoning has sometimes been carried too far. Granted that selling cost is not chargeable against production, but against profit and loss, it is nevertheless unnecessary and inadvisable in most cases to sever all connection between selling costs and items or lines of product, for when this is done, the possibility that it may cost more to sell some lines than can be covered in the price secured for them is in serious danger of being overlooked. The fact is that in any



business selling more than one type of product, it almost always costs more to market some than others, and here, as elsewhere, competition may require as accurate a knowledge of the real facts as it is possible to secure without too great expense.

HOW TO CHARGE COMMISSIONS, PREMIUMS, TRAVELING EXPENSES  
AND ADVERTISING COSTS

I once asked the president of a specialty concern in New England how he apportioned selling costs. He said "I do not try to apportion them. I know pretty well what the factory cost is, and at the end of the year I know my total income. The difference includes selling cost and profit. I have to cover selling cost, so I put the price as high as I can and in this way I usually come out ahead." This policy may be all right for awhile for a small concern, but the progressive manufacturer to-day wants to know exactly what the selling costs are and to keep them as closely under control as he does his factory costs.

Selling cost includes the salaries of all the officials who are concerned entirely with sales and the functions connected with sales, such as advertising, credit department, traffic department, sales accounts, correspondence, schools, and the like. To these must be added a portion of the salaries of general officers, such as the president and treasurer, part of whose time may be devoted to the selling departments. In some industries elaborate estimates, sketches, drawings, experiments, or investigations may have to be made as a necessary part of selling the commodity or service. In these cases part or all of this expense may be charged directly to the order sought, but any part of it not so chargeable must be added to general selling expense.

Commissions, premiums and traveling expenses must, of course, be included in the general selling expense.

While in all cases a certain amount of advertising is for the benefit of all the products sold, and is therefore a general charge, it often happens that certain advertising is special and limited in its character and mainly for the benefit of specific lines. A company manufacturing a variety of products, such as shirts,

PROFIT AND LOSS STATEMENTS FOR MONTH OF _____ 19__									
NAME OF ACCOUNT		AMOUNT			NAME OF ACCOUNT		AMOUNT		
<b>ADMINISTRATION EXPENSES</b>					<b>PROFITS ON BOLT DRIVERS</b>				
INSURANCE FOR MONTH					" " BORING TOOLS				
INTEREST					" " CASNETS AND STANDS				
DISCOUNT					" " C CLAMPS				
ALLOWANCES					" " CLAW BARS				
SALARIES, OFFICERS					" " CUTTING OFF MACHINE				
" CLERICAL					" " CUTTING OFF TOOLS				
POSTAGE					" " D & R HOLDERS				
TELEGRAPH AND TELEPHONE					" " DGS				
OFFICE SUPPLIES					" " DCL. DRWTS, AUTOMATIC				
DONATIONS					" " " " COMMON				
LEGAL SERVICES					" " DRILL SLEEVES				
MEMBERSHIPS					" " DRILL SOCKETS				
RESERVE FOR BAD DEBTS					" " GANG PLANNER TOOLS				
					" " DRILL VISES				
					" " GRINDING HOLDERS				
					" " KNURLING TOOLS				
					" " PLANNER JACKS				
					" " PLANNER TOOLS				
					" " RATCHET DRILLS, PACKER				
					" " RATCHET DRILLS, SHORT				
					" " RATCHET DRILLS, STANDING				
					" " RATCHET DRILLS, UNIVERSAL				
					" " SETS A D & D				
<b>SELLING EXPENSES</b>					" " SIDE TOOLS				
SALARIES					" " SLOTTER TOOLS				
COMMISSIONS					" " THREADING TOOLS				
TRAVELING EXPENSE					" " TOOL POSTS				
TRADE JOURNAL ADVERTISING					" " TURNING TOOLS				
CATALOGUE AND CIRCULAR ADVERTISING									
CUTS AND ENGRAVINGS									
EXHIBITS									
					<b>PROFIT ON SINGLE PARTS</b>				
					" " ASSEMBLED PARTS				
					" " PURCHASED MATERIAL				
					" " CONSIGNMENTS				
					" " WASTE SALES				
<b>NET GAIN</b>					<b>INCOME FROM PROPERTY</b>				
<b>TOTAL</b>					<b>TOTAL</b>				

FORM 27

*This monthly profit and loss statement shows the administrative and traveling expense and the profits on various accounts. This helps to localize profits and to discover leaks.*



shirt-waists, petticoats and undergarments, will usually advertise each of these lines separately, and if it uses catalogs may have a separate catalog for each class of product. Care should be taken to charge the special advertising to the line to which it is devoted in order to bring out into the open the varying costs of selling different lines.

SHOULD DELIVERY COSTS BE CHARGED TO PRODUCTION  
OR TO SALES?

In some companies costs of packing and shipping, including the expense of the traffic department, are charged as a selling cost. This expense is on the border line between production and sales. There is much to be said for the proposition that the product is not completed until it is packed and delivered at the f. o. b. point. So long, however, as the expense is covered either under production or sales, it is comparatively immaterial which method is used, except that where a company delivers free over a very large territory, the consequent wide variation in delivery costs should not be charged to production, as the variation would produce confusion in production costs.

Many companies guarantee to replace, free of charge, defective articles or parts, if the defect is reported in a reasonable time after the sale, and even, in some instances, to provide a certain amount of labor in the form of service without extra charge. The cost of such replacements and service is evidently chargeable to selling expense, for the chief object in providing the service is to assist sales.

It is often the case also that service departments are maintained in the factory, and service stations at different points where repairs are handled. Charges are made for their work. These charges rarely cover the actual cost of the service, and the usual deficit also must be charged to the selling account.

All the costs already enumerated in this chapter are derived from salary and expense vouchers, from requisitions for supplies used, and from purchase orders and contracts for advertising.

As stated before, where but one line is manufactured, the selling price of which is practically uniform and constant, there is no great gain in making any distribution whatsoever, except a simple arithmetical apportionment of selling expense per unit of product to insure setting a selling price which will cover the total cost. Where a variety of product is manufactured, however, it is desirable to segregate it into groups whose selling expenses are different.

For example, a company may make a line of staple goods, which it sells by catalog, and another of specialties, which it manufactures on order only. The comparative expense of selling these lines is certain to vary widely. In such case the cost directly attributable to each line should be charged directly to it.

In any case where it is desirable to apportion selling expense, there will be a certain amount of that expense which is general in its nature and not chargeable, therefore, to any given line. As with general factory expense, this general selling cost must be apportioned on some arbitrary basis.

HERE IS THE USUAL BASIS ON WHICH GENERAL SELLING  
EXPENSE IS APPORTIONED

Three methods of apportionment are commonly used. By one of them, the selling expense is distributed in proportion to the number of hours of labor spent on the product; by another it is apportioned in proportion to the direct wages cost; by the third, according to the total factory cost. In the great majority of instances, one of these methods is as good as another, and it becomes merely a question of relative simplicity and convenience in handling.

Unless the result would be altogether too misleading, the total factory cost method is the simplest.

It must not be overlooked, however, that the most expensive product is sometimes the easiest sold, in which case it would evidently be unfair to charge it with a share of selling expense proportionate to its cost. In this whole field the method used



must be governed by the sound common sense of the responsible authorities, bearing in mind that the object of any distribution of selling expense is to aid in securing an intelligent control of sales policy and methods.

A convenient means of keeping track of all selling expenses is illustrated by part of Form 18A-F (18E and F, on pages 122 and 123).

There remains the question of tying the factory's cost books into the general office's accounting books. This interesting subject is taken up in the succeeding chapter by a certified public accountant, Frederick B. Cherrington. Mr. Cherrington's chapter is followed by two more chapters by myself about a specific phase of cost accounting—classification systems and analyses of cost systems—and two chapters, descriptive of typical cost systems, by Warren L. Green, president of the American Bank Note Company, and H. A. Harris, secretary and treasurer of the National Regulator Company.

## IX

### TYING THE COSTS INTO THE GENERAL ACCOUNTS

By Frederick B. Cherrington  
Certified Public Accountant

In order properly to coordinate the books of the factory with those of the general office, the three factors entering into costs—material, labor and indirect expense—must show upon the general books as general ledger accounts.

Inasmuch as material may consist of raw stock, goods in process of making, or goods completed and ready for sale, and as their several relations to the accounting department vary, each should be considered as in a class by itself.

The stores account in the general ledger bears the same relation to the various kinds of raw stock carried that a customers' ledger controlling account bears to the various individual accounts of the customers. At the beginning of any period, the amount of the account should be the total of the values of all stores on hand.

The account should be debited during the period with stores purchased, the various accounts with commodities in the stock ledger or balance of stores record being debited with the individual entries. The stores account should be credited with totals of materials used, listed by individual kinds, and at the end of the period should represent the inventory of all raw stock on hand. The account would be represented as follows:



Dr.	WORK IN PROCESS		Cr.
Inventory at beginning of period . . . . .	.00	Goods withdrawn during period . . . . .	.00
Purchases during period . . . . .	.00	Balance will show amount of inventory	

Certain conditions may make it advisable to have this account subdivided. This is especially true where a concern is making many distinctive articles, each requiring an especial class of raw stock, or where storerooms are widely scattered. Each of these subsidiary accounts, however, would control its own group of stores records.

To record properly the second step in making the product, another general ledger account is necessary. This is ordinarily called "work in process" or "manufacturing." The former term is both expressive and convenient.

Just as the stores account controls the raw stock, so will this work in process account control the manufacturing of the article itself. Regardless of the kind of cost system employed or the methods adopted for distributing indirect expense, the account will contain the three essentials—material, labor, and indirect expense.

To the ledger account then will be charged materials, labor, and indirect expense, applying against work in process; and goods completed and ready for sale will be credited to it. The balance should represent the value of unfinished work. The account may be thus expressed:

Dr.	WORK IN PROCESS		Cr.
Inventory at beginning of period . . . . .	.00	Finished goods at cost of manufacture . . . . .	.00
Material . . . . .	.00		
Labor . . . . .	.00	Balance will show inventory value of	
Indirect expense . . . . .	.00	unfinished work	

The above account is in its simplest form.

Business demands may indicate the need for several manufacturing accounts, such as:

Brass foundry—Work in process  
 Iron foundry —Work in process  
 Factory " —Work in process

In actual practice, moreover, the account may contain certain manufactured articles which are not to sell. Improve-

ments to plant and machinery, or new machinery, fixtures or equipment manufactured, are credited to "work in process" and charged to asset accounts, if they permanently increase the value of the plant. Repair work performed by one department for another is also carried through this account.

In order to record the value of goods finished and ready for sale, it is customary to withdraw all finished goods from the "work in process" account and carry the values thereof into a ledger account which is usually termed "finished goods." This is a controlling account showing the total of all completed goods manufactured and ready for sale.

The detailed list is shown on the stock ledger or balance of stores record. Many concerns with varied lines of product find it advantageous to subdivide this account on the general ledger and to use a controlling account for each class of article. Thus a concern manufacturing valves might have several finished stock accounts, as, to mention several specifically:

- Valves—all iron
- Valves—iron and brass
- Valves—all brass

Occasionally finished goods are retained as part of the work in process account until sold, though the practice is not considered a good one except under peculiar conditions.

Dr.	FINISHED GOODS	Cr.
Inventory at beginning of period . . . . .	.00	Cost value of goods sold during period.. .00
Goods manufactured during period at cost.....	.00	balance will show inventory value at end of period
Goods returned by customers at cost...	.00	

As direct labor is directly related to the cost of a given article and indirect labor becomes a part of the indirect expense, the general ledger will carry a payroll account somewhat as follows:

Dr.	PAYROLL	Cr.
Weekly payrolls.....	.00	Direct labor to work in process..... .00
		Indirect labor to indirect expense..... .00



When the books are closed on a basis of thirteen equal periods of four weeks each, the above account would balance exactly at the end of each period, unless several days' pay were withheld by time-keepers, as is often done to permit clerks to figure their payrolls more carefully. In this event, and in case a business is closed upon calendar months, there will remain in the above account a credit balance representing labor accrued and unpaid. The amount of this balance thus becomes a liability and appears on the books in the general balance sheet.

Indirect expense is one of the most important of all the accounts appearing on the books of the manufacturer. Methods of handling its distribution have given rise to more arguments than the problem of the descent of man. It is the rock upon which many a ship of industry has been wrecked, and while different modes of treatment all have their advocates, even in the same industry there is much variance of opinion.

Briefly, the indirect expense account is one which, as Mr. Thompson has already pointed out in previous chapters, carries all those indirect items which are necessary to the conduct of a manufacturing concern. They are, in part:

Indirect Labor	Insurance
Taxes	Water
Heat, light and power	Repairs
Rent	Depreciation

Some of these items may be definitely applied to departments. Some may be known exactly in the aggregate, but can be only arbitrarily apportioned.

This ledger account is charged with all items of indirect expense and credited with amounts charged periodically to "work in process." It is handled this way:

Dr.	INDIRECT EXPENSE		Cr.
Indirect labor from payroll account . . . .	.00	Indirect expense applied to "work in process" . . . . .	.00
Departmental expenses . . . . .	.00		
General expenses—insurance, taxes, etc. . . .	.00		

The entries which are to be made on the general books to the various controlling accounts may be expressed by a simple

## HOW TO FIND FACTORY COSTS

DEPT.		MACHINE RATE						
MONTH	NO. OF MACHINES IN DEPT.	TOTAL HOURS RAN		EXPENSE TO RUN	MACHINE RATE	TOTAL HOURS IF RAN FULL TIME		MACHINE RATE IF RAN FULL TIME
Jan.								
Feb.								
Mar.								
Apr.								
May								
June								
1ST HALF YEAR								
July								
Aug.								
Sept.								
Oct.								
Nov.								
Dec.								
2ND HALF YEAR								

FORM 28

This simple machine rate card is a convenient means for recording the total estimated hours and the total actual hours, and for making adjustments which experience may show to be necessary.

AMERICAN BANK NOTE COMPANY							
ORIGINAL		DATE <u>Aug 28</u>		DEPARTMENT			
		I HAVE THIS DAY DELIVERED TO THE <u>Steam Press</u>					
		THE FOLLOWING PAPER FOR USE ACCOUNT OF JOB ORDER NO. <u>475</u>		PROCESS NO. <u>8</u>			
PURPOSE <u>4 1/2% B. &amp; O. Bonds</u>							
NO. OF SHEETS	SIZE AND WEIGHT	DESCRIPTION OF PAPER	1 SIZE AND WGT. BEFORE CUTTING	NO. OF SHEETS	COST PER UNIT	AMOUNT	
1456	8 1/2 x 11 1/4	#1-A bond	—	—	01	14	56

FORM 29

This is the form of requisition used by the American Bank Note Company. No paper can be obtained from the storekeeper except upon presentation of an order like this.



series which I will now give—in practice they may be somewhat further subdivided.

Dr. Payroll.....	.00	
Cr. Cash.....		.00
Amount of payroll for period		
Dr. Stores.....	.00	
Cr. Vendors or Accounts Payable.....		.00
Recapitulation of stores purchased for period and charged to individual stores record		
Dr. Indirect expense.....	.00	
Cr. Payroll (indirect labor).....		.00
Cr. Vendors or accounts payable (expense bills).....		.00
Charges to indirect expense for period		
Dr. Work in process.....	.00	
Cr. Payroll (direct labor).....		.00
Cr. Stores (stores consumed).....		.00
Cr. Indirect expense.....		.00
Manufacturing charges for period		
Dr. Finished goods.....	.00	
Cr. Work in process.....		.00
Value of goods manufactured for period		

The "finished goods" account up to this point will contain the value of goods on hand ready to be sold. A few additional steps, however, are necessary when the sales are made.

An account called "cost of sales" represents the cost price of goods sold—that is, the values at which goods have been carried in the "finished goods" account prior to actual shipment. The cost price of goods returned by customers must be credited to this account. It may appear thus:

Dr.	COST OF SALES	Cr.
Value of goods sold at cost price (credit to finished goods).....	.00	Value of goods returned at cost price.... .00

This account is ordinarily allowed to run until the end of the fiscal period, and upon the completion of inventories of "stores and work in process," it is adjusted enough to correct any variations in these two accounts. It is finally charged off to the profit and loss account, and, by comparison with the sales account, which is closed at the end of the fiscal period by credit to the profit and loss account, will show the amount of the trading profit.

Dr.	SALES ACCOUNT		Cr.
Value of goods returned by customers, at selling prices..... .00		Value of sales charged to customers, at selling prices..... .00	
Dr.	ACCOUNTS RECEIVABLE		Cr.
Value of outstanding accounts at beginning of period..... .00		Value of goods returned by customers, at selling prices..... .00	
Sales charged to individuals, at selling prices..... .00			

Both the "cost of sales" and the "sales" accounts in a large concern may be divided into classes by sales segregation, and when several of these groups of sales are maintained, corresponding cost of sales accounts will be carried.

The "accounts receivable" controlling account may in its turn be subdivided to provide controlling accounts for two or more ledgers, such as, alphabetically by names, A-K, L-Z; or, geographically, City-Country, Foreign-Domestic. I know of many concerns operating accounts receivable in as many as twelve divisions, and have in mind one concern where thirty-six customers' ledgers are not only operated, but balanced exactly.

A continuation of the general ledger entries after the finished goods stage may be represented as follows:

Dr. Accounts receivable.....	.00	
Cr. Sales.....		.00
Value of goods sold at selling prices for the period		
Dr. Cost of sales.....	.00	
Cr. Finished goods.....		.00
Value of goods sold at cost prices for the period		

Goods returned by customers present a slight complication, for they must be credited to customers at selling prices and charged back to stock at cost prices. The following entries show the intent clearly, the original sale entries being simply reversed:

Dr. Sales.....	.00	
Cr. Accounts receivable.....		.00
Value at selling prices of goods returned by customers during the period		
Dr. Finished goods.....	.00	
Cr. Cost of sales.....		.00
Value at cost prices of goods returned during the period		

It is doubtful if any entry is slighted oftener than the one mentioned just above—crediting returned goods at cost prices.



Many large and apparently well-ordered concerns ignore this feature in handling returned goods. They continually credit customers and charge finished goods with the selling prices of the goods returned. In some cases the difference between cost and selling prices on returned goods may cause a shrinkage in the inventory of several thousand dollars.

## X

### A SYSTEM OF CLASSIFICATION THAT MAKES IT HARD TO FORGET

Aunt Delia's city nephew was watching her put up the week-end store of pies.

"What are you marking that 'TM' on those for?" he asked.

"So's I can tell what kind of a pie it is. I fill this up with mince meat, and mark it, and then when I look at the crust it stares me in the face: 'TM'—' 'Tis Mince.' "

"But you've marked this apple pie 'TM' too."

"Of course I have, sonny. That 'TM' means "Taint Mince." I haven't been makin' pies fifty years for nothing."

Aunt Delia missed by only two points a perfect system of classification and naming by symbols. She neglected to distinguish between the numerous pies that are not mince, and her symbol lacked the quality of meaning only one thing. Otherwise she was all right, and has supplied an introduction to this, the first of the two chapters on classification systems and analyses of cost systems, which I have already mentioned.

The correct method of classification is summed up in two words: analysis, the enumeration of elements; and synthesis, the re-grouping of details.

To begin with, you list all the facts of your business, every detail and element, down to the last paper of pins and the last stamped envelope. Each bit of material in your storerooms, in process or in stock, each machine, tool, work-place and operation, each bit of income and expenditure, and the duty of each



official and workman. At least this much must be definitely on paper and in your mind's eye before you can begin a comprehensive classification.

In practice you will not actually classify all these at once, of course. But to be in position to make ultimately a complete and unified classification, you must see that the field is staked out from the beginning, even if only in outline. You are really writing your own insurance policy; and it is up to you to see that nothing of value is left off the list. It is the things you forget that always make the trouble.

Next comes the re-grouping of all these elements into the classes to which they logically belong. Each element must find its appropriate place according to the purpose of the classification.

THE FIRST STEP — CLASSIFYING DETAILS AND ELEMENTS —  
AND A VERY IMPORTANT ONE

If, for instance, you are dealing with functions, you will group the duties of the directors in one place, those of the executives in another, those of the workmen in another, dividing the latter up by departments or by the kind of work they cover. In handling charges, you will start with the old favorite division into direct and overhead expenses; and then subdivide into labor and materials, and shop and general expense, finally subdividing the last group to suit your taste. Your routing classification will include operations, materials, parts in process, machines and work-places and tools. When these are done the filing classification, as will be shown later, will take care of itself, for it is nearly identical with those already suggested.

Certain items will appear in more than one classification; but there is no cause for alarm in this. Instructions for the operation of a monotype keyboard may be in the functional classification for details of method; in the routing classification for checking progress of work; in the charging classification for proper allocation of expenditure; and in the filing classification for reference to data. The same facts are dif-

## HOW TO FIND FACTORY COSTS

[illegible]

FORM 30

*This record shows the tally of the issuing room from day to day, and gives an accurate record of "goods" and "bads." After the job is completed, the "bads" are burned up.*

[illegible]

FORM 81

Here is the ultimate check on all departments. The last tally is entered on this permanent record, which must balance with the original requisition on the storekeeper for paper.



ferently classified for different purposes. They appear under the same name or symbol in all the lists; no confusion, therefore, results.

Everything will go well if you are logical and accurate from the start.

The basis of classification is the similarity of certain elements in the things grouped together as "alike," and dissimilarity between other elements which distinguish one class from another as "different." Men are classified as animals, like the apes, on account of numerous similarities of structure; but they are distinguished as men by the points of difference. Men are classified into races by including all with the same color of skin or the same shape of the head together in the same race, and all of different colors of skin or shapes of head in other races.

USE OF CROSS REFERENCES TO FACILITATE RECOGNITION  
OF PROPER SYMBOLS

The elements of similarity or of difference chosen for industrial classification must be significant and essential; significant with reference to the purpose of the classification, and essential in the nature of the object classified. If you are classifying pencils with reference to charging them as direct or indirect expense, it is immaterial whether they are blue or not. If they are classified functionally, with reference to the purpose for which they are used, it makes considerable difference whether they are blue or black. The blueness is accidental in the first case, significant in the second.

Now that, with the aid of these few simple principles, you have corralled all your elements, and have rounded them up in logical and accurate groups, to suit your needs, you must brand them with marks which will make them capable of easy identification. A classification is no good unless you use it, and use it constantly. To use it conveniently, some system of naming the elements must be provided.

Now one type of machine may appear under several different classifications. It is this "cross-reference" factor in classification that makes one basic system of symbols essential so that the object symbolized will always be recognized.

A name is itself a symbol; "desk" is the symbol for a thing we write upon. When we want to designate a detail, such as the lever in the lock in the upper left-hand drawer of a desk, ordinarily we must use just this set of words. But it is too long for practical purposes, especially if we are to designate it very often, as one might in the manufacture of locks. It must be shortened into a symbol, which will mean exactly the same thing at all times and in all places, and never anything else. This symbol, since it is a shortcut, must be easily handled and, if possible, easily remembered.

HERE ARE THE FOUR QUALITIES WHICH WILL MAKE YOUR SYSTEM OF  
SYMBOLS PRACTICAL AND EASY TO USE

A good system of symbols must have four qualities: First, simplicity combined with efficiency, with the emphasis on the efficiency. Simplicity in itself is no virtue; in the attempt to handle complex conditions it may be a vice. You are a careful manager, and you demand simplicity; when you go to the office in the morning you use the simplest vehicle you can find—a wheelbarrow, with your janitor or gardener for motive power. Or perhaps I am mistaken. You really prefer efficiency to simplicity, and go in an automobile, the height of complexity. In the same fashion, a system of symbols should be as simple as is consistent with efficiency. Many concerns still use a simple number system, running consecutively from one to a million—as simple as a wheelbarrow.

The second requirement is definiteness. There must be just one symbol to one thing, and one thing to one symbol, and the twain must be one. It ought not to be necessary to put your finger on a thing in order to identify it.

That is, of course, the time-honored way, still used. Men will say: "Order a desk like this" or "a ream of stationery like





### A PLATFORM FOR THE SALVAGE

*This platform was built for "salvaged" tools when one plant decided to abandon the methods under which, to use the words of its president, "every workman got all the tools he wanted, as many duplicates as he could, in addition, and stowed them away." The illustration on the following page shows some of the "salvaged" materials piled on top of this platform*



### ON TOP OF THE "SALVAGE" PLATFORM

*Here are some of the "salvaged" tools piled on top of the platform shown in the illustration on the preceding page. Thousands of dollars' worth of tools were brought together for orderly issuance by the establishment of the central tool room to which this platform is an adjunct. The illustration on the preceding page indicates the placing of the platform*



that," notwithstanding that in nearly all other relations of life language has carried us beyond the pantomime stage. Classification has given the name perfect definiteness of identification; the symbol should have this same definiteness.

MAKING IT EASY TO REMEMBER  
THE SYMBOL

Third, the symbol should have a mnemonic quality; that is, it should be capable of being easily remembered. This is of the greatest importance. It makes symbols convenient and easy to handle without constant reference to a key. It serves as a check on accuracy; if a symbol is incorrectly made, the next person reading it will notice that it means nothing. A mnemonic symbol which follows the classification of the thing symbolized sums up that classification in itself, as I will show, and is, therefore, a perfectly definite and logical means of identification.

Finally, it must be brief. Practically this offers no difficulty, for any symbol is certain to be briefer than the name for which it stands, to the extent of from one-third to one-twentieth the number of letters. Here is a choice specimen from a catalog: "Lower-left-hand-cutting-blade-set-screw-lock-nut"—a full-blooded linguistic dachshund. A perfect symbol for that could not consist of less than eight or ten letters.

The system which seems to meet all the tests laid down, yet comprehends the whole scope of industrial activity, is a combination of letters and numbers, predominantly mnemonic, which has been worked out mainly by Frederick W. Taylor and group influenced by him.

This system is based on a complete and exhaustive analysis of every detail of labor, materials and organization involved in a business, as previously explained. The resulting list of elements is then regrouped in a logical classification; first into broad general divisions, then each division into its subdivision, and each subdivision into as many groups and sections and sub-sections as the nature of the business requires. Letters are

used for each division, subdivision, and so on. Wherever possible they are made suggestive, either by the use of the initial letter of the name or some other significant letter, or by being used always for the same thing.

Numbers are used for dimensions or for job numbers, depending for their meaning on their special position in the symbol. Numbers are also sometimes used for the individuals in a class, as these ultimate elements are often so numerous as to go beyond the possibilities of the alphabet. They are also used at the beginning of symbols for operations, to indicate the first, second and succeeding operations on the piece symbolized.

A GOOD EXAMPLE OF A SIGNIFICANT  
SYMBOL

Obviously the same letter will often be used for different things, according to whether the thing is a division, a group or a section. Its particular meaning, therefore, depends upon its position in the symbol. In the symbol ASAMP the first A has a meaning as part of a division, the second A another significance as part of a group. It is just as it is with digits, which in the decimal system derive their significance from their position in the group. Thus 333 means 3 hundreds, 3 tens and 3 units. There is no reason for confusion in one system more than in the other; and no one would read this combination of digits other than as three hundred and thirty-three.

To make all this clear, suppose we construct a functional classification, taking for our example a small printing plant. This classification will include all the activities of the plant, productive, administrative, and selling, and will be broad enough to use for all purposes: costing, routing, control of materials, duties of officials, methods of work, sales organization and filing. We shall select one item to classify and symbolize: the instructions for the operation of a monotype keyboard.

It is clear that in the broadest view, this business consists of manufacturing, selling, and the connected administrative



and auxiliary activities. Auxiliary activities are those which are directly connected with production, such as power and light; administrative are those which are necessary to the conduct of the business, but do not enter directly into the product, such as accounting.

HALF THE TRICK IN APPLYING THESE PRINCIPLES  
TO A SMALL PLANT

For convenience we shall break up manufacturing, for our general classification, according to classes of product, and will also segregate stores and materials and the operations and accounts connected with the purchase of land, buildings, new equipment and tools. This utilizes more letters for broad classes, shortens the symbol, and is an aid to accounting. Then we set down the letters of the alphabet in column, omitting the I, O and Q on account of their similarity to the figures representing one and zero, and fit our classes in, as indicated in the table given herewith, by means of which the entire system of classification is illustrated in connection with the typical operation of a monotype keyboard.

To continue the classification of manufacturing, D, by departments:

DC Composing Room  
DP Press Room

Analyzing the composing room, DC, with reference to various features, we get:

DCA Composing room functions not elsewhere classified  
DCB Miscellaneous labor  
DCC Fixtures, furniture and apparatus  
DCM Machines and work-places  
DCR Reclamation of errors  
DCS Stores  
DCT Tools  
DCZ Buildings

The next step is easy: DCM, machines and work-places, includes:

DCMP Proofreaders' tables  
DCMM Monotype machines  
DCMP Proof presses  
DCMS Imposing stones  
DCMT Type stands

AMERICAN BANK NOTE COMPANY	
RECORD OF COST	
DATE 19__	
<b>PLATE FINISHING</b> NAME OF JOB _____ NO OF JOB _____ KIND OF JOB _____ QUANTITY _____ PAPER _____ INK _____	
<b>ENGRAVING</b> MODELING _____ ENGRAVING _____ TRANSFERRING _____ ALTERATIONS _____ STEEL _____	
<b>BURDEN</b> _____	
<b>LITHOGRAPH</b> MODELING _____ ENGRAVING _____ TRANSFERRING _____ ALTERATIONS _____ PRINTING _____ MATERIAL _____	
<b>BURDEN</b> _____	
<b>PRINTING</b> MILLMAN _____ ROTARY _____ ROBERTSON _____ SINGLE PLATE _____ HARD _____ WETTING _____ DITING _____ BLANKETS AND PADS %, PER 1000 _____	
<b>BURDEN</b> _____	
<b>FINISHING CHARGES</b> AS PER DETAILS ON BACK _____	
<b>TYPE CHARGES</b> _____	
<b>PRINTED AT BRANCHES</b> _____	
<b>GENERAL BURDEN</b> _____	
<b>TOTAL COST</b> _____	
<b>AVERAGE COST PER 1000</b> _____	
<b>SALES PRICE</b> _____	
<b>PROFIT</b> _____	

[illegible]

FORM 32

Whether the job has paid or not appears on this apparently uncomplicated record of cost.

FORM 33

*This record shows the exact cost of everything that goes into the ink required for any job.*



Monotype Machines, DCMM, divide naturally into

DCMMC Monotype casting machines  
DCMMK Monotype keyboards

Operation is obviously P, so the symbol we are seeking is

DCMMP Operation of monotype keyboard

We can go on as far as we like in the analysis of keyboard operation, for tabular work, straight composition, justification, and so on.

This symbol is a complete classification and identification in itself. The instructions in question are evidently for the operation, P, of the keyboard, K, of the monotype, M, which is a machine, M, in the composing room, C, which is part of the manufacturing, D, end of the business. The symbol identifies the machine for the routing department, indexes the instructions in the methods of work, shows the accounting department that any charge in connection with these instructions is a manufacturing indirect expense, and provides the filing department with a self-indexing system for filing all data on the subject.

A CLEAR EXPLANATION OF SEVEN SYSTEMS NOW IN USE AND HOW  
THEY ARE APPLIED

Almost every manager has been driven at times to some variety of symbolization. It is usually some expedient gotten up on the spur of the moment for some special purpose, such as identifying costs or salaries, or shortening names of frequently used items. There are, however, a few serious attempts at systematic symbolization, besides the one just described, which it is worth while to consider and to test by the qualifications laid down.

There are several arbitrary systems, some of them made up entirely of numbers. One manager symbolizes the parts of a machine by dividing it first into groups and numbering them consecutively, and then dividing each group into its elements, also numbered consecutively. In the wheel group, which is the fourth, there are front hubs, front flanges, and so on. These are symbolized thus: 4/1, 4/2, and so on. The classification here appears to be practicable, and it is easier to write "4/1" than "front Hubs."









### ANY WORTH-WHILE TASK IS "BIG"

*Building any important product is a "big" job—and a cost system that watched the minutest details saved one company hundreds of dollars. In fact the president of the company calls the results "startling." The system—somewhat like that described in this book—is so exact, so flexible, and yet so adaptable, that it may be applied to a small group of workmen or to a very large plant*



Brevity, however, is the only advantage of this method. It is not definite, for it does not, without further description, indicate the type of machine to which the hubs belong. It is therefore not really simple, and it is not mnemonic. A similar system has been proposed for identifying costs: (1) annealing; (2) assembling; (3) babbitting; (4) bending; (5) blowing; (6) boring, and so on. This is subject to the same adverse criticism, besides being based on no logical classification at all.

A WELL-KNOWN ACCOUNTANT USES THIS  
SIMPLE SYSTEM

Many managers use a system which is an arbitrary combination of numbers and letters. For instance, one symbolizes departments thus: A, administrative; B, legal; C, business, general office; D, sales; E, accounting; F, purchases; G, engineering; H, drawing; I, planning; and so on. This plan is used to identify workmen and departmental expenses. Thus 4G is workman number 4 in the engineering department; G4 is a subdivision of engineering expense. A well known accountant symbolizes private ledger accounts by the same method. A to D is assets; E to H, liabilities. Cash is 1A; notes payable, 1E. These are all short, definite, and comparatively simple; but they lose all the advantages that would accrue if they were suggestive.

Sometimes you find a combination of arbitrary and mnemonic characters in a symbol. At times an effort is made to give mnemonic quality to numbers alone by grouping them. This has been applied especially to the classification of expenses. Thus one man gives this for a foundry: Direct labor, 150 and 151; various expenses, 152 to 160; supplies, 165 to 169; maintenance, 170 to 175; departmental expense, 180 to 187; miscellaneous 190 to 194; commercial (administrative), 200 to 207; and commercial (selling), 215 to 220.

Another large establishment groups, somewhat less minutely, into administration expense, 101 to 179; distribution expense, 181 to 199. This system is short, definite, slightly

mnemonic, and simple—too simple, in fact. Those using it must either memorize the meanings of groups and of single numbers, or else constantly be referring to a key. It is therefore inconvenient to handle.

CARRYING THE GROUP IDEA TO ITS  
LOGICAL CONCLUSION

The group idea is carried to its logical conclusion in the Dewey decimal system, well known from its use in public libraries. This apparently elaborate system, when applied to a logical classification, is in fact simple; and when frequently used it is highly mnemonic on account of its strict and logical associations. It is brief and very definite. It can be applied to the filing of any data in an industrial or commercial establishment, simply by making a basic classification to fit the case; as, for instance, for catalogs, clippings, drawings, memoranda, and so on. Its great disadvantage is that its use is practically limited to filing.

Under the Taylor system, as already indicated, the symbol for the instructions for the operation of a monotype keyboard would be DCMMKP. Let us compare this with what it might be by some of the methods just described. By one method it might be 233; by another, 17/11; by another, J6; by another, 14C (slightly mnemonic)—all of them short and fairly definite, but too simple to be efficient, and in most cases not in the slightest degree suggestive. Another method might symbolize it MON4, which would be better than any of the others. The Dewey system would perhaps call it 677.823.19. Most of these systems could not classify and symbolize such a detail at all, except in a purely arbitrary fashion; and such a symbol as they could furnish would necessarily have an exceedingly restricted use.

The advantages of the Taylor system are, first, that it is absolutely definite; for the moment you introduce a new factor, you have to change the symbol. Hence you can have but one symbol at any one time for each thing. It is mnemonic, for the



letters remind you of words whenever possible, and the arrangement in a logical classification indicated by the position of the letters in the symbol helps out your memory of their significance. That it is brief in comparison with the full name of the thing symbolized is obvious. It is as simple as is consistent with effectiveness; and in practice is far simpler than other systems, on account of its qualities of definiteness and suggestiveness.

WHY THIS SYSTEM IS USED IN "SCIENTIFIC  
MANAGEMENT"

In addition to these advantages, the classification on which the system is based includes the entire business, and consequently the symbols used are applicable in every department and for every function, including accounting, routing, handling of stores and stock, checking progress of work, methods and details of selling, the filing of all records, correspondence and data, and the arrangement and location of materials, parts in process, stocks of finished goods, tools, machines and work places.

It is self-indexing, like a dictionary or a city directory. This not only expedites the finding of any material, part, or record wanted, but greatly facilitates for the cost department requisitions, time tickets, bonus tickets, and so on.

The time must come when a complete classification of all business will be made, similar to the Dewey classification of all knowledge. This is a task which calls for the resources of the Government, or, in default of them, it should be undertaken gradually, but with determination, by our great universities. And when it is made, I think the details should be symbolized in accordance with the system advocated in this chapter. In the next chapter this subject is carried into still additional detail—a partial analysis and classification for a factory is given—and several of the earlier chapters in the book summarized.

# XI

## TAKING FACTORY COSTS APART

It is probably too much to say that a business can not exist without an adequate cost accounting system. Factories have struggled along for years without it.

There is a concern in a western city which has what some might call a model accounting system—that is, taking “model” in the sense of “a miniature imitation of the real thing.” The owner, who is the buyer, chief clerk, accountant, and repair man, has one book—the ordinary ten-cent Manila-covered butcher-shop memorandum book. On the left-hand page he enters all expenditures, dated but unclassified—this includes such items as postage, wages, cartage, advertising, insurance, magazines, and also his personal expenditures. On the opposite right-hand page are listed all receipts, also unclassified—receipts from sales, repairs, interest on money loaned, and so on.

These columns are footed on each page, carried forward to the next, the grand totals taken at the end of the month, and the balance indicates to this man his profit or loss for the period. Depreciation, discount, and such details as that are too fussy for him to bother with. The business has been run on this basis for going on ten years; and the fact that, while he is doing but a \$60,000 business, he has on his shelves about \$50,000 worth of stock aged anywhere from one to ten years, has not thus far worried the proprietor.



A man with one lung can get along, too. He lives, but his vitality is low and his life is comparatively short.

It is too much to say that a man can not live on one lung, just as it would be rash to assert that a business can't get along with such a cost system as that just described.

WHY "ONE-LUNG" BUSINESSES USUALLY  
NEVER GET WELL

Most people, nevertheless, if they have a choice, prefer two lungs at least. So the business that wants to be healthy and long-lived prefers some cost accounting system which is at least sufficient for its needs. Our friend's business, for example can hardly get along permanently with a system which shows less than many times the amount of information he is now getting.

In a good many factories, all the costs are carried in the manager's head. This same manager's head also carries all the information in regard to raw materials ordered, on hand, issued and needed.

He also knows all about the time his orders are to be delivered, just what stage of development they have reached in the factory, what goes into them; and when and how. This wonderful head also knows all about the men employed, how long they have been there, how good their work is, when they are deserving of promotion or advancement, and how they ought to do their jobs. The only fact its owner refuses to take a chance on is the money due from customers—here, at least, he is willing to admit that a paper record is better.

An analysis of the contents of such a head would show that it is made up of a jumble of general impressions about everything, with very little definite and accurate information about anything. The man who knows the facts about his business is one who records those facts as they arise and classifies the information thus recorded.

This is particularly true of factory costs, for cost accounting, though in principle comparatively simple, is in practice





necessarily complicated, involving as it does many little and elusive items.

In analyzing and classifying your costs, the first thing to do is to find out what they are, and for this you will have to depend on records, and not on any man's head, however capacious. Material costs, as already indicated in previous chapters, should be taken directly from requisitions, without which no materials should be allowed to go from the storeroom. These requisitions should give the quantity, value of the material and the order number or the indirect expense to which it is to be charged.

All work done in the plant should also be recorded either on a work ticket, which is the workman's authorization for expending his labor, or on some other kind of reliable record which records the amount of labor the workman has performed. This ticket or record should also indicate the order or the expense to which the labor cost is to be charged.

When materials and labor are to be charged to specific products, there is no great difficulty encountered in allocating the cost. The trouble comes in connection with the materials and labor and supervision that are to be charged to indirect expense. Indirect expenses are so numerous and varied that classification becomes absolutely indispensable.

Once made, however, a classification becomes most easily workable when reduced to a mnemonic system of symbols as outlined in the previous chapter. Such a plan and method of classification and symbolization, applicable with slight modification to practically any manufacturing plant, will now be more fully described in this chapter.

#### TAKING THE FIRST STEPS IN CLASSIFYING SYMBOLS

The first question should be: "Is the product, on which work is done, to be sold?" If the answer is "Yes," then the charge is a direct one against product or "worked materials," which will ultimately be sold as merchandise. If the answer

is "No," then the question is: "Does the work done, or the material used, increase the permanent value of the plant?"

If it is for land and buildings, or machinery and motive power, the answer is undoubtedly "Yes," and you will have two accounts: one for "land and buildings," and the other for "construction." If it is for fixtures, apparatus, tools, and so forth, which depreciate rapidly, and on which it may be advisable to charge half the cost at once to "shop expense," and the other half to "construction," as previously explained, you have an account for "part construction;" and half the cost in this account will be transferred at regular intervals to "shop expense."

DO YOU ADMIT THE IMPORTANCE OF STARTING WITH  
A KNOWLEDGE OF EXACT COSTS?

If the work done, or the material used, does not increase the permanent value of the plant, then it must fall under the head of "general" or "departmental" expense. There are some departments of your business the work of which does not directly affect the product at all. For example, your accounting department and your selling organization. You can manufacture without them if you are interested only in making a product.

You may charge one set of expenses then directly to the selling department and another set to what you may call administrative or business departments. Another class of your expenses is necessary to carry on the work of manufacturing, such for example, as power, storerooms and tool rooms. Without them, the product could not be manufactured at all. And yet they do not enter visibly into the finished article to the production of which they are essential.

These may be either general expenses applicable to the whole plant or departmental shop expenses applicable to one department or another. Most of the last few pages may appear to contain but a recasting of material given in previous chapters—as a matter of fact that is so, for they are a summary





### A BIG CUT IN COSTS

*The adoption by the Pullman Company of a system that put a careful check on costs and methods resulted in remarkable savings. In the department which is illustrated above, for instance, the "shop shortage" account alone was cut fifty per cent at least. This is typical of only one of the many benefits which usually result from the installation of a good cost system in a factory*





which I hope will serve well as an introduction to the immediate subject matter of this chapter—analyses and classification of costs—to which I will now at once turn.

LAYING A FOUNDATION FOR  
YOUR ANALYSIS

Suppose we lay out a base sheet. First, arrange the alphabet in column, omitting I, O, and Q; then fit in the broad classifications already given, following so far as possible the mnemonic method. You may call the general expenses which are necessary for the manufacture of the product "auxiliary;" administrative expenses may be termed "business"; selling expenses may as well keep their own name; shop expenses may be called "departmental"; you may also have an item for erecting, if the nature of your product is such that this is essential. These can go in at the top of the alphabet; and the last letters, X, Y, Z, may be for "part construction," "construction," and "land and buildings." Your base sheet will then look like this:

- A Auxiliary
- B Business
- C Selling
- D Manufacturing Departments
- E Erecting
- F to R Products
- S Stores, Raw Materials
- T Tools
- X Part Construction
- Y Machinery and Motive Power
- Z Land and Buildings

This leaves the letters from F to W, inclusive. In order to connect this classification with other purposes of the factory than cost accounting, it is advisable to use S invariably as the first letter in the symbol for raw material. Similarly T is reserved for tools in the plant, where they are an important factor. The other letters then may be used for classes of product: such as G for grinders, K for milling cutters, M for molding machines, and the like, or K for coats, T for trousers, U for suits, V for overcoats and so on.

Then you will proceed to subdivide each of these items. For instance, your auxiliary group of expenses, A, might be further analyzed like this:

AA to AD Unassigned  
 AE Experiments for the benefit of manufacturing  
 AF  
 AG  
 AH Heat, light and power  
 AJ to AR Unassigned  
 AS Storeroom  
 AT to AZ Unassigned

Then you will subdivide AH:

AHA Salaries or wages to the engineer and fireman when their work can not be charged to any other expense item of this department, and any other labor connected with the running of boilers, engines, generators, and other machinery in the engine room  
 AHB  
 AHC Fixtures and furniture, both fixed and movable, and tools and other minor equipment in the engine room. Repairs and maintenance, but not new work  
 AHD  
 AHE Engines, boilers, and all other machinery including line shafting, pulleys and belts in the engine room. Repairs and maintenance, but not new work  
 AHF Fuel. Includes all materials used in firing boilers, inclusive of freight and cartage, receiving and cost of disposing of ashes  
 AHG Gas used throughout building  
 AHH to AHP Unassigned  
 AHR Water rent  
 AHS Stores and supplies, including stationery, which can not be charged to any other expense item of this department  
 AHT to AHV Unassigned  
 AHW Piping and fixtures for steam, gas and water. Also all electric wiring, repairs and maintenance, but not new work  
 AHX to AHZ Unassigned

The same kind of analysis should be made of all other items, including the product, which may be subdivided into the various kinds of grinders, milling-cutters, or suits and overcoats made. To carry out this plan of classification in detail for a simple plant requires a small volume and is a task not lightly to be undertaken. Such a classification must be made by each plant in accordance with its own specific needs, following strictly the fundamental principles of approved cost accounting. When once done, however, it is done for good; and until it is done, the management must wander in outer darkness, so far as costs are concerned.

If every expenditure of labor or material is made on a written order or requisition, the symbol of the expense and the



order number should be on each one. When this is done, the cost department can have no difficulty whatsoever in properly allocating each cost. The allocation of direct labor and materials to the product made is easy; but the proper distribution of indirect expense over the product, where it must finally land and be paid for by the customer, requires experience and careful thought, as I have already indicated.

WHERE SOME COST SYSTEMS  
FAIL TO MAKE GOOD

A cost system may be a thing of beauty in itself, but not necessarily a joy forever. For practical men, it must pass the test of usefulness. A mathematician, well known to engineers, was once enthusiastically explaining to some visitors the solution of a problem on which he had been working. He had constructed a cylindrical model, open at both ends and with a crumpled up partition in the middle.

He explained that he was trying to work out a formula for certain relations between this warped surface and the cylinder. He looked into the cylinder from one end and announced a bristling formula for what he saw; then he viewed it from the other end and evolved another formula; then he squinted at it sideways and got still another.

"Now," he said, gesticulating wildly, "you multiply formula A by formula B, subtract C from the product, divide the remainder by C plus B and here's the answer." Striking an expectant attitude, he inquired, "What do you think of it?" One of the visitors, the manager of a machine shop, who had shrunk more and more into himself as the demonstration proceeded, remarked meekly: "That's fine; but what's the use of it?" Shaking his fist in the air, the mathematician retorted: "You idiot, it hasn't any use; that's the beauty of it."

The real beauty of a cost system, however, lies in its having a use. When an automobile company finds that each car is taking \$90 worth of brass, when \$80 worth would do, its cost system is surely at least worth \$10 a car. If the costs show that







a material costing \$160 is used in each car, when another material costing \$30 would do just as well, the cost system is worth at least \$130 a car for this service alone.

A cost system constructed with sufficient minuteness and detail will call attention to just such facts, provided the management studies the costs and reads them intelligently as they come from the accounting department. Two things are required: first, that the costs be detailed and accurate; second, that the manager treat them as an integral part of the business and make them serve the purposes of the business as definitely as the labor he hires. A perfect cost system in the hands of an unobservant or unintelligent manager is useless and expensive.

If your system shows that thirty per cent of your stock is of a kind which depreciates at the rate of fifty per cent per year and induces you to clean out that thirty per cent as quickly as possible, it may be worth to you the difference between prosperity and bankruptcy. And here again you must get facts that are real facts and act on them with judgment and decision.

A COST SYSTEM IN THIS AUTOMOBILE FACTORY MADE POSSIBLE A  
DIFFERENCE OF \$240 IN THE PRICE

The cost system in one automobile factory that enabled the management to cut off an even \$240 from the price of one of its models, was a comfort both to the manager and the consumer, for both gained thereby. A good cost system thus has its bearing on the fortunes of our old problem, "the high cost of living."

It takes as much judgment to know when to stop doing a thing as when to do it. A system of records which is indispensable at one time and for one purpose may be no longer needed when that time has passed and its purpose has been fulfilled.

In most places a cost system, once developed, should be maintained; but there are plants in which it may be discontinued once it has established the cost of the product made. In a



pottery factory, for example, manufacturing the same line year in and year out, getting its materials at the same price and able to account easily for variations in labor cost, once the cost of a line is determined, the system may safely be allowed to fall into disuse, retaining only so much of it as might be necessary to ascertain the cost of a new line, if such should be taken on.

The conditions under which such a policy would be safe are rare, and the best rule, when in doubt, is to keep your cost system. In any action to abolish it, the burden of proof is on the alleged exception.

From all of which you will see that it's a case of using your own judgment as a business man when it comes to costs. I have simply endeavored to explain in this chapter, and the preceding ten chapters, some of the facts involved in the hope that this explanation would help you in forming your judgment. We will now turn to descriptions of two specific cost systems by officials of the concerns using them, and thus close the book.

## XII

### A COST SYSTEM THAT SAFEGUARDS

By Warren L. Green

President, The American Bank Note Company.

That absolute accuracy in checking the work of special manufacturing is necessary to the continued success of a business, is now a generally accepted fact. How this methodical checking is carried through all operations in turning out a single job in one plant will be described in this chapter.

All stock is carefully watched. Not only must all ink be accounted for by requisition, but paper, too, is subject to the same conditions. Paper stock is obtained from the storekeeper on a separate requisition (Form 29) and one form is used for each job order. The issuing room's tally appears from day to day as a record (Form 30) of "goods" and "bads"—the "bads" are held until the completion of a job and then incinerated upon a written order (they refer to valuable securities and must be carefully destroyed). Nothing yet devised will enable an employee to explain a discrepancy between the number of sheets delivered to him and those returned.

This factory habit of accuracy becomes ingrained. "How many have you got?" was the unconscious inquiry with which some of the forms represented here were handed to me by an old employee whose life had been a constant drilling in accountability. Even stock forms had value in his eyes.



Bond work of this kind is usually "tissued" to prevent off-setting, and experience has shown that a uniform handling in lots of one hundred means simplicity in verifying, because checkers become accustomed to that fixed allotment and are more apt to note discrepancies when the total in any one pile is supposed to be the same. So the issuing room sends the job out on each successive day made up in that way. The odd sheets are held till another allotment of one hundred is ready.

From the printing department the work with the pressman's record goes to the finishing room where the perforating, numbering, trimming, binding, folding and other final touches are added. Here is the ultimate check on all departments. Every detail of the order is compared with the product to see if instructions have been properly carried out. The last tally is entered on a permanent record (Form 31) which must balance with the original requisition on the storekeeper for paper.

THIS IS THE ULTIMATE TEST OF A  
GOOD COST SYSTEM

"Has the job paid?" This routine of counting, sorting, checking and watching must crystallize on the factory manager's desk in profits or the tedious labor is lost.

The neat-looking envelope in which the cost accounting department has summarized the job in figures may have stamped on its face a red star, which means: "Done at a loss." There is no getting away from the figures. They are analyzed at every step. This record of costs (Form 32) represents the result of two years' work given over to gathering data on machinery, materials and labor.

When the pressroom ordered its ink for the bonds on which the profit or loss now appears, the exact cost was determined on a blank (Form 33) which showed the direct and diffused labor, as well as the materials (oils, varnishes, dryers, and so on), used to produce every pound of it.

In the business of engraving, the ink may vary with every job and only by careful records is it possible to determine the





## 145

FORM 40

FORM 44

*This form is the reverse of the card shown in Form 43, and completes the information required regarding costs of installing various grades of pictures.*



#### IN A CENTRAL TOOL ROOM

*The tools are kept carefully sorted in racks at one company's plant, and there is a special method for checking on those which must be returned after the men are through. Instead of sharpening their own tools in a distant tool room, the men receive sharp tools for dull ones at their work-places. This feature alone has resulted in an attractive saving*



cost per thousand impressions for any one run. Ink is an expensive item in high-grade work, especially so in printing from steel plates. For example, in printing two hundred and ninety thousand bonds composing a loan of the New York, New Haven & Hartford Railroad, twenty-seven tons of ink were used, or more than twice the weight of the bonds themselves. The reason lies in the process of plate wiping, familiar to engravers, by which only a small portion originally applied remains to bring out the impression.

Careful records must be kept of every press and of every worker at the press, for the amount of ink employees will use varies on the same press.

CAREFUL RECORDS SHOWED THAT THE INK USED ON A PRINTING JOB  
WEIGHED JUST TWICE AS MUCH AS THE PAPER!

By comparing these figures, by letting the pressmen themselves know and comment on them, much can be done to economize. In the form as finally perfected, account is taken of the manner in which the ink is ground and mixed, the proportions of oil, varnish, dryers and miscellaneous coloring-matter entering its make-up, and the machine on which it is run, and other factors calculated to show exact costs and results. These are summarized on one section of the form just described and forwarded to the cost accounting department (Form 34).

The time checks of each employee, showing department, name, job, number, pay an hour and number of hours employed, are likewise assembled, classified and recorded by the cost accounting department on forms (Forms 35, 36, 37) designed to show the entire history of work on each job handled in the factory.

From these forms are taken the summarized figures that are laid on my desk each morning in connection with jobs on which delivery has been made.

In the final cost as there shown, is included both the departmental and general "burden." These are figures for each month and the percentage of cost for the month in which a job

was done is included with the cost of that job. The burden of repairs to buildings, taxes, insurance, lighting, depreciation, water, superintendence, indirect labor and material in each department, is a part of that department's burden. Taxes, for instance, are apportioned in accordance with the floor space each department occupies.

To the general burden is assessed the cost of operating the storekeeper's purchasing and experimental departments, together with general administration expenses.

WHAT AN AUTHORITY SAYS ABOUT GETTING COSTS  
ON FINISHED MATERIAL

Following is quoted some allied material about costs, prepared by W. H. Staynes:

"To get costs on finished material that has required a score or more different processes presents accounting difficulties to every manufacturer. This is especially true of leather finishing where the product is handled in bulk, for the most part, and usually involves two dozen or more distinct operations to complete it.

"The records used in one large tannery for following work through every step involve an excellent system of daily postings and cost summaries. The system has been in use for a number of years and has proved of vast service in providing against losses resulting from wide fluctuations in the price of raw material. It offers suggestions for many other businesses.

"Production cost records are carried in a series of bound books and workmen's individual time sheets. The posting begins from the moment a load of raw hides is received and classified. These preliminary costs are entered in the first costs book (Form 38) by lots, each lot taking a consecutive number. This book is ruled across two pages and is provided for such entries as: date goods received, description, lot number, weight, cost and the first thirteen stages of production.

"The exact cost for each process is secured and entered daily by means of the time sheets (Form 39) which the workmen are required to leave at the office each evening after finishing their day's work. These sheets, like all the other records, provide for entries by lots, as the leather is handled in this way entirely.

"The workman merely indicates on his sheet the amount of work done and time required. The rate, amount and charge are filled in at the office.

"Each morning the clerks take the time sheets for the previous day and enter the costs in the proper columns of the first cost book. For instance, the first process is 'breaking.' Workmen's time sheets show the cost of the process for a particular lot and it is entered in the proper column. The next time sheets will total the cost for the next process 'unhairing,' and so on through the various stages until the lot comes out as 'crust stock.' The



leather is then classified and the sum of the costs of each process gives the total cost of the lot, which is entered in the last column of the book.

"Hides wanted immediately are posted to the finishing cost book (Form 40) but if not immediately required, they are posted to the 'crust stock' book (Form 41), which gives a complete record of all 'crust stock' in hand. The production then stops until the goods are required, when they are posted to the finishing stock book.

A GOOD EXAMPLE OF HOW COSTS ARE SUMMARIZED  
AND BROUGHT TOGETHER

"Into this book the totals of finishing costs are posted. As the finishing may be different for different portions of a particular lot, the lot numbers may have to be added to, so as to indicate the part of the lot being dealt with, in which case the previous 'crust cost' is averaged over the different sections of the lot before posting to the finishing cost book. In this book all work from the completion of 'crust stock' to actual finished hides is covered.

"The two sections of cost, 'crust' and finishing, are then summarized, the overhead charges added, and the total cost obtained. The finished hides then go to the warehouse, and are posted to the finished stock book (Form 42); the number of skins, total area, and cost are entered. As sold they are entered on the opposite side of the page, with area and selling price. As these hides are of a high-class character for special work, they are sold by the square foot, and the area is therefore an essential feature of the costing.

"In other classes of hides sold by weight, the weight would take the place of the area entry, with the same result. The advantages of such a production cost system are at once apparent. For the costs of a given lot of raw material are not only followed through the yards, step by step, but the costs by stages serve as a constant index to the efficiency of every department and each individual workman of the organization.

"Thus a manufacturer using a system like this is enabled to locate instantly the cause of any departure from normal cost and is assured at all times that the margin between the cost and selling price of any given lot is sufficiently large. A weak link in any one particular process may result in a loss on the whole. But by this method the weakness is detected the instant it appears and can be rectified before it does harm.

"The system has the further advantage of being handled with few forms. This element of cost keeping is a vital one, for it makes less possible mistakes that might occur with a more elaborate system and reduces the labor. Many other advantages of the plan will be found in using it. For some businesses additional features for handling costs might be developed."

# XIII

## MAKING COSTS AND BIDS AGREE

By H. A. Harris

I am not a theorist, but a technical man, and I have found it necessary to have a cost for these five reasons:

First, to give me a record of operations so that the progress being made on a building may be observed and a satisfactory profit insured;

Second, to prevent a loss on any one section due to ignorance of conditions;

Third, to keep men from "laying down" on any one branch of the work;

Fourth, to govern prices in the making up of future estimates;

Fifth, and finally, to record such salient facts as will be necessary for future reference.

Two instances will show the vital importance of knowing the cost of work.

One concern had no cost system. Bids for this concern were prepared by a "practical" man who professed to know costs. A quotation had been submitted on a large office building, and for several reasons the company was the logical one to do the work. It was selected from among the other bidders and given the preference by the owners.



However, the officials were told that their bid was too high. They were asked to cut the price by about \$5,000. The estimator went over the figures carefully and finally decided it was too much of a risk. He believed that taking the work at the lower price would probably entail a loss; so, after several conferences, the contract was passed up.

**THE INSTALLATION OF A COST SYSTEM SHOWED WHY THIS COMPANY LOST  
A PROFITABLE ORDER BY BIDDING \$4,500 TOO HIGH**

This company later installed a cost system. When sufficient data had been secured to govern future quotations, a cost was prepared on this particular building. It was then found that the price originally submitted was unreasonably high; had they accepted the contract for the amount named by the owners, they would have made a splendid profit. The building was a representative one at the time it was built and has since had additions made to it; so that the loss due to refusing the original contract was not the only one entailed.

A second incident will show the other side of the question. In my own experience I prepared a quotation on one of the largest office buildings in the middle west. The conditions were practically the same as in the illustration previously mentioned, except that I was asked to make revisions in the figures on account of certain changes in the plans, and with a view to lowering the figure sufficiently to obtain the work. I had a splendid record of costs upon which to base the original quotations and it required only a few adjustments in the estimate to bring it in accordance with the changes. The business was secured, and after the work was completed, I checked the finished cost against my original estimate and found that there was a variation of only one-half of one per cent. This I consider close enough for all practical estimating purposes.

After many years in this line I have developed an unusually efficient and satisfactory method, and by varying it to meet special requirements, it is applicable to the smallest as well as to the largest business. It is the system I am now using.







To obtain construction costs properly, the material as shipped must be charged against the building. The practice in vogue with many contractors is to enter material only when it is paid for, the entry coming direct from the cash book. This is absolutely wrong, as it does not give the superintendent watching the detail the true state of conditions; nor does it allow the material not entered to be taken into consideration when billing the owner as the work progresses. Not entering the material as it is shipped to the building understates the investment, and is misleading to one observing the construction operations. The equity, which should appear in every financial statement, is also incorrect. The understatement will probably "fool" the contractor into a false idea of the profits being realized, and I have known it to result disastrously.

HOW ONE MAN DEVELOPED AN UNUSUALLY EFFICIENT AND  
SATISFACTORY METHOD

If material is not entered as deliveries are made to the building and any disputes should arise, causing the bill to be held up, it might be months, or even years if litigated, before the bill is finally entered in the investment. I have heard many complaints voiced by auditors, surety companies, and financial guarantors, as to the difficulty experienced in determining the investment on a building where this extremely inadvisable and uncalled for method was practiced.

A cost that is broken up into the various classes—showing labor, material and other divisions of the investment at a glance,—produces the best results. I have seen bookkeepers who were compelled to spend three or four days analyzing an entire account, when labor or some other item was required. Should this occur during a rush period, it would place unnecessary hardships upon the accounting department.

Dividing the cost also allows the official in charge to watch the progress being made on each section of the building; and when considered in connection with the construction reports submitted by the foreman weekly or at other times detailing



the work, this method provides all the information necessary in guiding the operations. It may also eliminate a loss which would otherwise not be discovered until it was irreparable. The superintendent knows from the condition of the detailed cost, and the foreman's report, when a portion of the work will probably overrun the estimate; and by instituting vigorous methods at once, the cost is kept down, thereby overcoming what otherwise would have been a loss. I do not mean by this that losses can always be overcome, but many are incurred which could have been entirely prevented or greatly lessened, had there been some intimation that the work was costing more, or would probably cost more than it should.

DETERMINING THE RELATIVE EFFICIENCY  
OF TIME UNITS

By watching the detail, I have found that superintendents will be valuable on some classes of work, while they will lose money on others. The cost system points out the strong and weak qualities of the men, and allows them to be placed in their most efficient field. A cost system of this nature has a stimulating effect upon the workmen, also, for they soon learn that there is an automatic check upon their labors, and that it will be impossible for them to hold their positions unless they work up to their best ability.

The labor or time is therefore the first consideration for the cost system. It is not difficult to obtain the material and break it up into its various classes, provided it is properly handled; but it is not so easy to obtain the time, correctly classified according to the various divisions.

I have used a classified time sheet for the past seven years and in my experience I have never had the least criticism as to its effectiveness. I do not ask the men to classify the time down to the minute, as that is impracticable for the average building workman. Moreover, I have found that a "fairly accurate" division of the day's work is sufficient for a practical cost. A little "give and take" will induce the men to cooperate better







than if they are held absolutely to the minute. They know that the office is in possession of a wide range of cost data and it can not be deceived by a slight variance on any one branch of the work.

Some workmen can not write well and many foreigners are employed who can not read nor write our language at all. For such men the time reports can be made out by the superintendent or timekeeper. They are seldom employed as foremen; but in case they should be, they will have someone else make out the time carefully for them. They will not jeopardize their chances of steady employment by having the time wrongly or inaccurately classified, and therefore subject to investigation.

THE NECESSITY OF ELIMINATING VARIATIONS IN REPORTING TIME  
BECAUSE OF DIFFERING PERSONALITIES

At the time the classified report was put into operation I was informed by all with whom I talked that the sheets would never be filled in accurately. I was told that the men would intentionally mis-classify their time, and the attempt would have to be discontinued. It was pointed out that our competitors had tried the same plan, but owing to the lack of cooperation on the part of the men and their failure to divide the time correctly, it was unsuccessful and had to be given up. In the beginning I myself encountered several instances where the men intentionally mis-classified the time in an endeavor to discourage me and do away with the report; but in each case the attempt resulted directly to the workman's disadvantage. When a class of work on any building showed an excess in time, an immediate investigation was in order. After the men found that the results were being carefully watched there was no more trouble.

The time report (Forms 43 and 44) carries full details, covering not only the workman's salary, but also his expenses and sundry purchases. The report must be signed by the



employee and approved by his superior, making it a complete voucher.

While the labor cost in dollars per unit is necessary in supervising the work, there should also be a cost in hours. Where the trades have both journeymen and helpers, the hours should be divided accordingly. The hour unit is advantageous in figuring buildings in different localities, since the labor should be consistent in hours but may vary in rate. Thus the hour basis is the only practical method of reaching an accurate result in supervising operations in new territory. The divisions on the cost records, therefore, should include the hours of labor as well as the cost of labor, in order to obtain standards.

SIMPLIFYING THE RECORDING OF TIME REPORTS  
ON THE PAYROLL

At the end of the week when the payroll (Form 45) is made up, the time reports should be entered thereon by name and number. The number may be given to the man permanently, or a new number may be assigned each week. If there are less than two hundred or three hundred employees I prefer the latter method, as it is much easier to enter the reports as they are received, one below the other. Furthermore, separate reports are used for each building upon which time or expense has been put in, and where an employee has been working on several contracts during the week, his entries on the payroll will take more than one line. If the lines are numbered consecutively and assigned permanently, confusion will result.

On the reverse of the payroll sheet (Form 46) I have spaces ruled into sets of three divisions each. The latter are divided by very faint lines so as to facilitate simplicity in entering. The three divisions indicate, respectively: labor; expenses; material.

The reports are sorted and entered by buildings, the numbers of the men now being used to indicate the workmen whose reports are included in each charge. This facilitates future reference in searching for information, audits, and so on. The

amounts from the reports are placed in their proper divisions, indicating at a glance what classification on the ledger they should be posted under.

As checks are drawn or cash payments made to the men, the check numbers and the amounts covering these disbursements are entered on the payroll, and since both the total amount to be paid and the payments made should balance, discrepancies are prevented.

WHY IT IS EASY TO KEEP A CLOSE CHECK ON CONTRACTS  
UNDER THIS SYSTEM

Each contract received is entered as an account and numbered consecutively. The accounts are carried in the current ledger, and may be arranged in numerical order or alphabetically by cities.

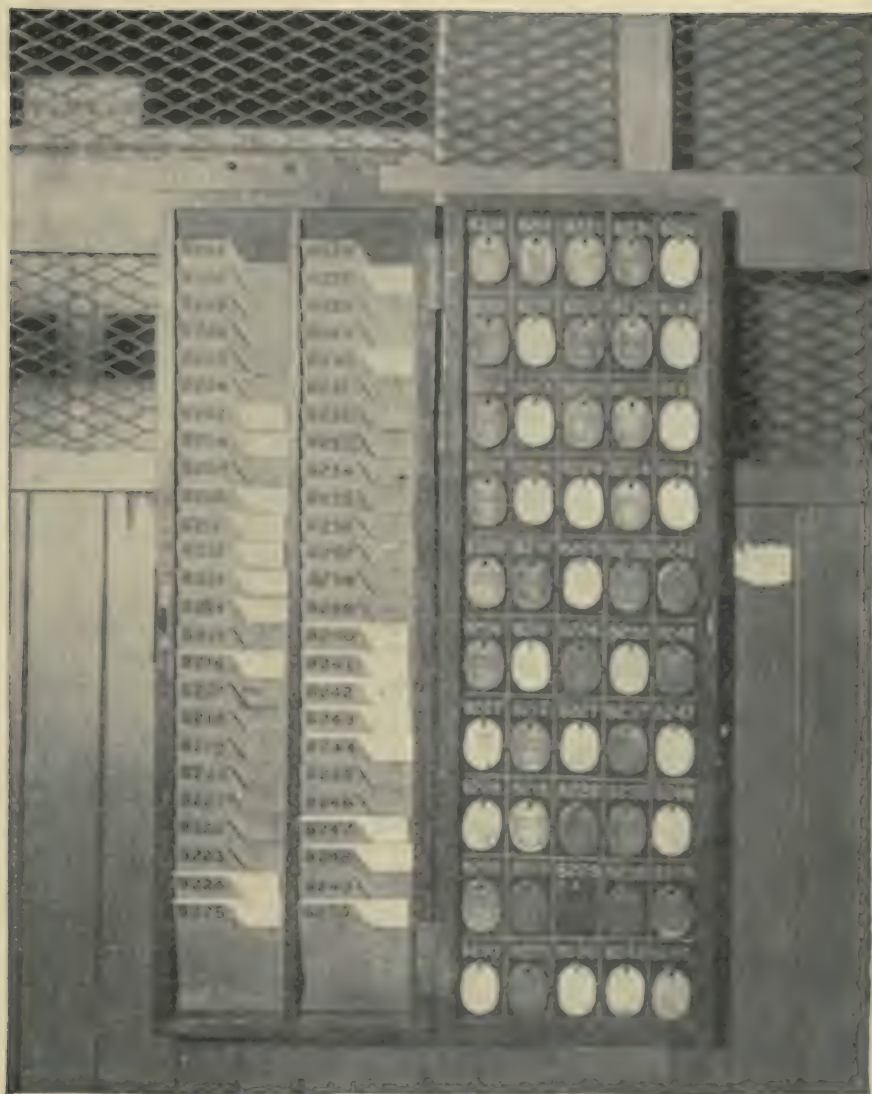
The index of the ledger is kept on cards, one card being made out for each contract. These are filed geographically. A city having a number of contracts has the cards filed under it subdivided according to the various classes of buildings. Thus, the buildings in any one section of the country are all grouped together, a grouping which is of great assistance in inspecting and referring to work already installed.

After the contract is entered, it is glued in a manilla folder, nine by fifteen and one-half inches in size, which is given the account number and filed numerically in a document case in the vault. All important papers that develop on the work, such as copies of the bond, extra orders, special agreements, and others, are glued in the same folder with the contract.

Current correspondence is carried in individual folders filed alphabetically by cities. After the contract is finished and paid for, the letters are arranged chronologically. The folders are filed "dead" by the account number. Plans and specifications are also carried by this number in their respective live and dead files.

The account number is really the contract index or "informant," hence is the key to all files contingent upon the work.





### SIMPLE BUT EFFECTIVE

*Each man has a numbered piece of brass which he receives as he passes into the yard and which he hangs over the proper square in a box like this when he reaches the section of the Pullman Company's plant in which he works. The brass pieces are deposited at the gate by the men as they leave. A glance will show whether or not all the men are at work*

## HOW TO FIND FACTORY COSTS

[illegible]

FORM 48

Here is the "secondary" ledger sheet, which contains complete, classified details of the cost, entered as the work proceeds. It is used entirely to check on the detailed costs. The headings are filled

[illegible]

FORM 49

Material from the warehouse is requisitioned on an order blank like this, which lists the classifications of the costs and carries a column in which the number of the class may be indicated.





Ledger sheets upon which the contract is entered, besides carrying the accounts and the cost, contain the following information:

The entries which are to be made on the general books to the various controlling accounts may be expressed by a simple series which I will now give - in practice they may be somewhat further subdivided:

- Account and contract number
- Name of building and its location
- Name and address of the party contracting
- Amount of contract and extras
- Terms of payment
- Architect
- Engineer
- Estimate of detailed cost, upon which work was taken
- Salesman and his commission
- Date of award
- Date of commencement of work
- Date of completion of work
- Detail of bond

Summary of cost at completion

Sundry remarks

And is complete with check columns, "forward" lines, and so forth.

The main ledger sheet (Form 47), hereafter designated as the "primary" sheet, carries two separate accounts, as follows:

(a) The construction account, or the investment and earnings on the building. The investment is divided into

Material

Labor

Hours of labor for the journeyman and his helper

Expenses of the men, freight, drayage, and so forth

Sundries, as commissions, bond premium, and other items chargeable to the contract

(b) The contractor's account, which is the personal account with the party who has let the contract, covers the following amounts:

Billed

Paid

Due

The investment, or debit, is kept "pure." By that I mean any adjustment of labor, returned material, overcharges, or other contras, instead of being credited, are entered in red ink in the debit and its divisions, and subtracted. Hence the debit always represents the actual investment on the work, and every classification column is a corrected division of this investment.



The credit of the construction account represents the earnings and is the amount billed. In this column profit and loss entries are made.

Amounts billed are charged against the contractor in his personal account, and payments which he makes are credited. In some cases bills are rendered to others than the contractor, as where extra work is done for others, in case of damages, or where two or more contracts are running on one building and they are of such a nature that they can not be differentiated in the investment. When such cases occur, the construction credit records the total billed; but the contractor's account will show only the account with the original contractor. Additional sheets are inserted as needed, or separate accounts are carried elsewhere, for the other parties.

ONE RESULT OF HAVING A SATISFACTORY  
COST SYSTEM

With my ledger pages open in front of me, therefore, I have at hand the entire book transaction on any contract; and until a building is finished, the profit taken off and the account paid, the detail is all at hand. This style of sheet is extremely effective when more than one contract is carried with the same company, as the accounts are necessarily kept separate and thus any possible confusion prevented.

The amount of the contract is entered on the primary sheet, together with any extras that later occur. Where the contract entails many extras, the back of the sheet, which is plain, is used for these records.

The "secondary" ledger sheet (Form 48) is the cost sheet. It is used entirely for the cost detail and is ruled on both sides in sets of columns, the sheet illustrated having six sets to the side. Each set contains four columns, with the following headings: units; labor; material; hours.

Each set has a blank box heading at the top, in which are written the divisions of the work upon which a cost is desired. The headings are filled in as the work progresses. Different

contracts are seldom prosecuted in the same order of operation. By providing for writing in the headings in this manner, therefore, the cost is kept compact and easily handled. The top margin on one face of the secondary sheet contains a summary of the completed work. The margin on the other side is reserved for general remarks.

HOW ONE COMPANY HANDLES ESTIMATES ACCURATELY  
AND WITHOUT MUCH RED TAPE

All estimates made by the estimating department or the men in the field are sent into the home office for checking and recording. Here they are given a consecutive number, indexed by a card system arranged geographically and filed "dead" by this number when disposition is made of the work. Until the work is awarded, they are carried in a current file by territories.

When a contract is taken, the estimate that secured the work is entered on the ledger. If it is too large for the space provided, details of the contract may be written on the back of the sheet. A reference is made to the estimate number and the date it was made.

There are many arguments both for and against this plan. The main argument against it is that clerks and others have inside information as to the figures, and this might leak out to competitors. This is true, but since each contract is generally figured somewhat differently from any other, due to peculiar conditions, and since the basis of figuring is continually changing, the estimates that are entered on the ledger are merely records of past prices, and will not serve any great purpose, even if given out. Therefore, this adverse argument is not very strong.

The main reason in favor of entering the estimate is that in watching the work, it is the governing factor; the standard, as it were, which is continually being consulted and used as the controlling lever in prosecuting the work to prevent loss. With this estimate on the ledger, discrepancies in present figuring



standards, and variations in the cost as the work progresses, are discovered sooner than they would be otherwise.

Costs on construction work differ from ordinary manufacturing costs in that they should not carry any burden, but should be the "pure" cost itself. Such items as telephone calls, telegrams, freight, drayage, and so on—costs that are directly chargeable to the building and can be figured in making up the original cost—are, of course, necessarily entered. But overhead expenses should never be included, although they should be considered in figuring the amount of profit.

Where a company is doing work that is not of an absolutely local character, freight, drayage, transportation charges, expenses of men, and other items, while they are chargeable to the contract and are included in the investment, should not be included in the detail of the cost until the work is summarized, unless figured as a portion of some particular division of the work. The latter should, therefore, contain only the labor, material, and the units installed. Cost and investment must not be considered as one and the same, for the former is only a portion of the latter.

THE IMPORTANCE OF PROPERLY CLASSIFYING EXPENSE ITEMS  
WHEN MAKING UP ESTIMATES

In compiling figures for estimates or for controlling operations on a building, items of expense should be considered separately and in proportion to the distance from the operating base. If these figures were buried in with the cost it would be a difficult matter to make cost comparisons or to estimate on buildings in different locations.

Where the company, however, is doing nothing but local city work, then drayage and similar expenses may be charged directly to the correct classification, since all the buildings will be on the same basis as far as operating conditions are concerned.

It must be borne in mind that the cost obtained is to be used for future quotations and that no items must be included

which arise from conditions peculiar to a restricted locality. There are exceptions to this rule, of course, and each company must take into consideration its own requirements and make the cost and its divisions conform thereto.

THIS METHOD IS USED BY ONE COMPANY TO REQUISITION MATERIAL  
SHIPPED FROM ITS WAREHOUSE

All material shipped from the warehouse of the company is requisitioned on an order blank (Form 49), which lists the classifications of the cost and carries a column, opposite the item, in which the number of the class may be indicated. Classifying the order in this way should be the task of either the clerk or the superintendent.

The bookkeeper divides the material correctly on the secondary sheet. If material is purchased and shipped direct to the building, instead of coming into the company's warehouse, the purchasing agent classifies the purchase order, as he should know the use for which the material is bought. If he does not know it, the superintendent may be called on for details. In checking bills, the clerk is now in a position to classify the material from the notations on the purchase orders, thus providing the bookkeeper with the proper information.

Portions of the work on a contract may be sublet to other firms. A "subcontract" of this sort is covered by a purchase order. If necessary, this may be based on a formal contract. Bills rendered on this work are treated the same as a part shipment of material on a supply order and are charged to the contract as received. Extras under this subcontract are handled by separate purchase orders.

In posting the labor with its contingent expense, and the sundry purchases made by the men, all of which are detailed on the time reports, the bookkeeper posts the total amount from the payroll book. Each entry is divided into labor, expenses and material.

The bookkeeper next refers to the time reports and posts the amount on each class, together with the number of hours,





#### WHERE SOME OF ONE PLANT'S COSTS ARE FIGURED

*When one large western company decided to adopt a new system of management, which its president calls a "common sense" system, it frankly admitted that it wanted accurate figures in making estimates. The situation was thoroughly explained to the men and they did not object to the careful check placed on costs by the new plan*



#### CUT COSTS DESPITE AN INCREASED PAYROLL

*This is a section of the brass department of one company's plant. In the finishing section of this department the Taylor system of routing is used. Despite the fact that this system increased the number of men required properly to supervise the work from seven to forty-seven, costs were reduced to an extent which entirely justified the increase*



directly to the cost division on the secondary sheet. The posting, therefore, appears in total under its division on the primary sheet, and is also broken up according to the various cost divisions on the secondary sheet.

Bills rendered are posted to the credit of the construction account, and in the adjoining column appear as a debit of the contractor. This is true in all cases except where the charge is against another party. Double posting made in this way on the same line prevents many errors and holds the contractor's account in true accord with the contract. This method is far preferable to having a personal account with the contractor, in which the records connected with several buildings are jumbled together.

SAVING ONE-THIRD OF THE BOOKKEEPING  
TIME IN BILLING

In making out statements or billing as the work progresses, the contract amount, terms of payment, amount paid, and other necessary facts are conveniently at hand. This fact saves countless minutes that would otherwise be wasted in searching for data—an especially aggravating procedure in busy periods. Collections also are handled to better advantage, since the amount originally figured, the investment to date, bills rendered, and payments made are all in one place for comparison.

At the trial balance periods, which usually come at the end of each month, the various divisions of the debit on the primary sheet are all totaled and brought into agreement with the investment. The labor and material items in the cost on the secondary sheet also are totaled and made to agree with the labor and material on the primary sheet; thus each month the entire ledger is in a state of perfect balance. The time entailed in gaining this result is not great, since there are very few entries in each column of the secondary sheet. This facilitates rapid work, and a ledger containing approximately two hundred and fifty buildings is balanced in about two and a half days.

When a contract is finished, the secondary sheet is ruled off and totaled, and the labor and material costs are divided by the units installed on each class of work. This gives the unit cost. The summary of the detailed cost is written at the top of the sheet. In this position it appears opposite the estimate, and the two sets of figures can readily be compared. The data are also entered in the general costs, from which new estimates and controlling figures are compiled and present ones corrected. After the contract is paid for, any soil, pencil or ink markings are removed with an eraser and the sheets are filed dead by number.

When profit or loss is taken off at the end of fiscal periods or when the work is completed, notations of the entry are made in green ink to differentiate it from other entries. The profit is entered under the credit column, the green ink being treated the same as a red ink entry; that is, as a deduction.

If, on the other hand, the contract shows a loss, the amount is entered in black, although the notations of the entry are made in green, and the black figures are, of course, added to the credit to offset the higher investment. The profit or loss should never enter into the debit or investment column, or confusion will result. While it is unnecessary to use green ink for these entries, I have found the practice extremely convenient as the color stands out prominently and quickly attracts the eye.

I have found it advisable in complicated work to use a "construction detail" book, the sheets being the same size as the primary, or preferably the secondary sheets, of the main account. The object of this book is to centralize in one place such details of the installation as the following:

Character of the work

Quantity of material to be installed, together with style, size and other identifications

Record of shipments or purchases to prevent excess deliveries

Conditions and progress in brief

When the contract is finished, the construction detail sheets are filed dead with the account sheets, furnishing complete



detail for future reference. The methods set forth may appear to necessitate considerable time in entering; but if the items are properly prepared before the posting is done, little additional work is entailed for the bookkeepers. It is a simple matter to classify and arrange the entries properly and I believe it requires no additional time. Furthermore, any book carried in detail should be "self-balancing," a feature highly recommended because of the accuracy insured.

A GOOD COST SYSTEM AS A REMEDY FOR  
SLEEPLESS NIGHTS

The amount of expense entailed in caring for such a system is small, and the accounts for two hundred and fifty current contracts are easily handled by two bookkeepers, who are also able to care for the other books of the company.

The value of a system of this character to me is incalculable. With it, I have facts backed by figures conveniently at hand, on which to base my estimates, and I spend no sleepless nights wondering if I am going to make a profit or incur a loss on any contracts. It is quite impossible for me, unless very unusual circumstances arise, to "fool" myself.

Two points materially differentiate the contractor's financial statement from that of the merchant. These two points, however, have not been generally emphasized by contracting accountants. Heretofore, except in a few instances, practically no attention has been given them. Their importance, nevertheless, is so great that without them no working statement or financial report can be compiled that will give an adequate idea of the condition of the business.

The points to which I refer, once their importance is fully realized, can be quickly located. They are:

- (1) The equity in contracts under construction;
- (2) The profit on contracts under construction.

What do I mean by the first? Just this: for every dollar expended in the prosecution of a contract a holding is established, which includes the amount expended plus the profit

thereby earned. If twenty-five per cent gross profit is figured, then for every dollar invested the holding \* is \$1.33 $\frac{1}{3}$ . If \$1.15 has been billed,† the equity is the difference—or 18.3 cents. The equity is therefore the portion of a contract that has been executed, with its profit, less the total bills rendered thereon. Expressed otherwise, it is the “unbilled” portion of the work done on a contract, plus the earned profit. The assets of a firm must therefore include this item. Without it, the report is seriously in error.

DETERMINING THE PROFIT ON WORK  
UNDER CONSTRUCTION

Obviously, the profit on work under construction must be determined before the equity can be obtained. Some method must be devised to estimate the profit as the work progresses and also to care for it on the books.

Material, unless installed, in almost all cases is not billable; therefore, until it is installed, it is not included by architects or owners in the payments. Considerable material must be on the ground to keep the men busy, and as the uninstalled material can not be removed without consent of the owners, the latter have a holding on it and it should be considered a part of the investment.

The amount of material on the ground is dependent upon the number of workmen, since men who are carefully chosen and supervised work consistently. The amount of material installed is therefore directly proportionate to the producing labor. I can not obtain any payment for the material on the ground not yet installed, but I can bill and be paid for the labor and the material that the labor puts in. The only deduction possible from these facts is this: the producing labor establishes the profit. Since the equity is the investment plus the earned profit, and since the producing labor determines the

\* Gross profits must be figured on the billing value, not on the cost.

† When an amount is billed, it immediately goes into the “Accounts Receivable,” and this latter asset shows automatically.





#### HOW ONE PLANT ISSUES SPECIAL TOOLS

*A three months' supply of tools is constantly carried in the central tool room at one unusually successful plant. The run of tools is issued from special branches in the various departments. The men are applying directly to the central tool room for special tools which must be returned before closing time.*

*This careful check on special tools helped to regulate costs*



#### SAVING MONEY IN ASSEMBLING

*When one company started to use a system that carefully checked on costs and methods, they often found "shortages" of many thousands of bolts, for instance, had been recorded at the end of a job. After the system was in operation a loss of only half as many was considered out of the question. The saving on raw materials alone thus amounted to thousands of dollars*



profit, it therefore follows that the producing labor is the basis upon which to figure profit. I thus have solid foundation for estimating the profit and equity on work under construction.

The determination of "profit on work under way" is not difficult; but placing it on the books periodically and automatically is a problem that has puzzled accountants most.

I have always run an analysis and cost on all contracts, whether large or small. The investment or debit of the account is divided into the following:

Labor

Material

Expenses, covering those of the men, freight, drayage, and other expense items

Sundry expenses, embracing commissions and items other than the actual expenses

As the contracts are completed I tabulate the analysis according to the classes of work, such as schools, churches, office buildings, factories, residences, and other divisions, as shown in Table I. This enables me to amass percentages like those shown, giving for each class of work the relation expressed in a percentage, of the labor, material, and so on, to the total investment, billing value and profit, and the relation of each of these items to the other.

Looking back over the records of the company for three years I found that, of the total contracts handled, in no year did the profit drop below twenty-four per cent, and that it averaged twenty-five per cent. The running expenses averaged around nineteen per cent.

In estimating the profit I needed to be sufficiently conservative to allow for unforeseen fluctuation in the percentages, and yet hold the profit above the expenses, I felt that two to three per cent was an ample margin; and if I could provide actual figures to check the percentages against, in order to prevent the estimated profit from running wild, I would be quite safe.

To provide such a safeguard, I placed on the report the finished business, with the actual profit earned thereon and the

percentage. This showed exactly what was being realized and indicated the margin I was operating under. With this check continually before me I had no opening through which to stray from the trail.

COMPILED PERCENTAGES							
	Sundry Expenses	Expenses	Labor	Material	Total Investments	Contract or Billing Value	Gross Profit
Schools and public work.....	\$ 1,946.00	\$ 8,033.84	\$ 57,788.94	\$ 81,704.20	\$144,473.88	\$189,205.18	\$ 44,731.80
Office buildings.....	9,941.39	8,899.78	80,609.74	94,671.48	187,882.34	268,100.30	70,217.94
Factories.....	2,746.90	6,737.42	23,358.12	36,202.64	73,153.08	95,567.90	22,414.82
Flats, residences and sundry small work.....	1,598.00	1,538.78	5,577.34	10,021.88	19,025.94	28,171.22	9,145.29
<b>Totals.....</b>	<b>\$16,223.24</b>	<b>\$23,969.59</b>	<b>\$167,642.04</b>	<b>\$226,700.20</b>	<b>\$434,535.06</b>	<b>\$581,044.80</b>	<b>\$146,508.84</b>

TYPICAL COST FIGURES							
	of the Sundry Expenses	of the Expenses	of the Labor	of the Material	of the Investment	of the Billing Value	of the Gross Profit
Sundry expense is.....		67.71%	8.456%	7.157%	3.734%	2.729%	11.07%
Expenses is.....	147.7%		14.29%	10.57%	8.016%	4.124%	18.39%
Labor is.....	1033. %	690.7%		73.97%	38.59%	23.85%	114.4%
Material is.....	1397. %	945.7%	135.2 %		62.10%	36.00%	158.3%
Investment is.....	2678. %	1813. %	250.1 %	191.7%		74.77%	296.5%
Billing value is.....	3562. %	2423. %	346.5 %	256.4%	133.7%		396.6%
Gross profit is.....	903.1%	611.4%	67.39%	64.65%	33.72%	23.2%	.....

TABLE I—The amounts and percentages given here are not taken from any particular business, and do not represent actual conditions in any line. They merely illustrate Mr. Harris's method of analysis, and show how he obtains a means of checking up with great accuracy the detailed costs on any job.

Three years' experience is certainly ample to ascertain the correct percentage of profit, providing the business is consistent; and it was safe to assume that as long as the company continued to figure new business on the same profit basis, twenty-two per cent would be a conservative figure at which to estimate profit for a working statement. This percentage would prevail throughout the fiscal year unless something unusual demanded a change. Since the reckoning is based on the yearly business, which furnishes a splendid cycle for "average" calculations, the profit, to be consistent with this average, must run throughout the year.

Figuring the percentage of profit earned to labor invested shows that the profit is 87.39 per cent of the labor (Table I).



That is, for every \$100 expended for labor, \$87.39 profit has been earned. On the same chart it appears that the gross profit is 25.2 per cent of the billing value. Labor, remember, is the most stable element of the cost.

FIGURING THE PERCENTAGE OF PROFIT EARNED  
TO LABOR INVESTED

If, now, we decide to take our profit on the basis of twenty-two per cent, leaving a margin of safety of 3.2 per cent, then, by proportion, we have the following:

The profit at 25.2%	:	The Profit at 22%	=	Percentage of labor on 25.2% basis (or 88.39%)	:	Percentage of labor on 22% basis (or 76.29%)
---------------------------	---	-------------------------	---	--	---	--

Therefore, at twenty-two per cent gross profit, the percentage of profit to the labor is 76.29 per cent.

After I had secured these facts, I opened two new ledger accounts:

- (1) Construction profit and loss estimated;
- (2) Construction profit and loss suspense.

The former see (Diagram VII) carries the estimated profit until the end of the fiscal year, at which time an adjustment makes it "actual." The latter serves as a depository to hold the estimated profit until the adjustment, and is the account that produces the profit used in obtaining the equity.

Placing the estimated profit on the books periodically and automatically is now a clerical detail. The bookkeeper multiplies the producing labor on the payroll by the percentage to obtain the profit, and then makes the following entry:

Debit construction profit and loss suspense.....	\$2375.42
Credit construction profit and loss estimated.....	2375.42

This records, we will say for the sake of example, the profit on contracts under construction for week ending June 24th, 1915, estimated at 76.29 per cent of the producing labor. The value of this method will instantly be seen. On every report,

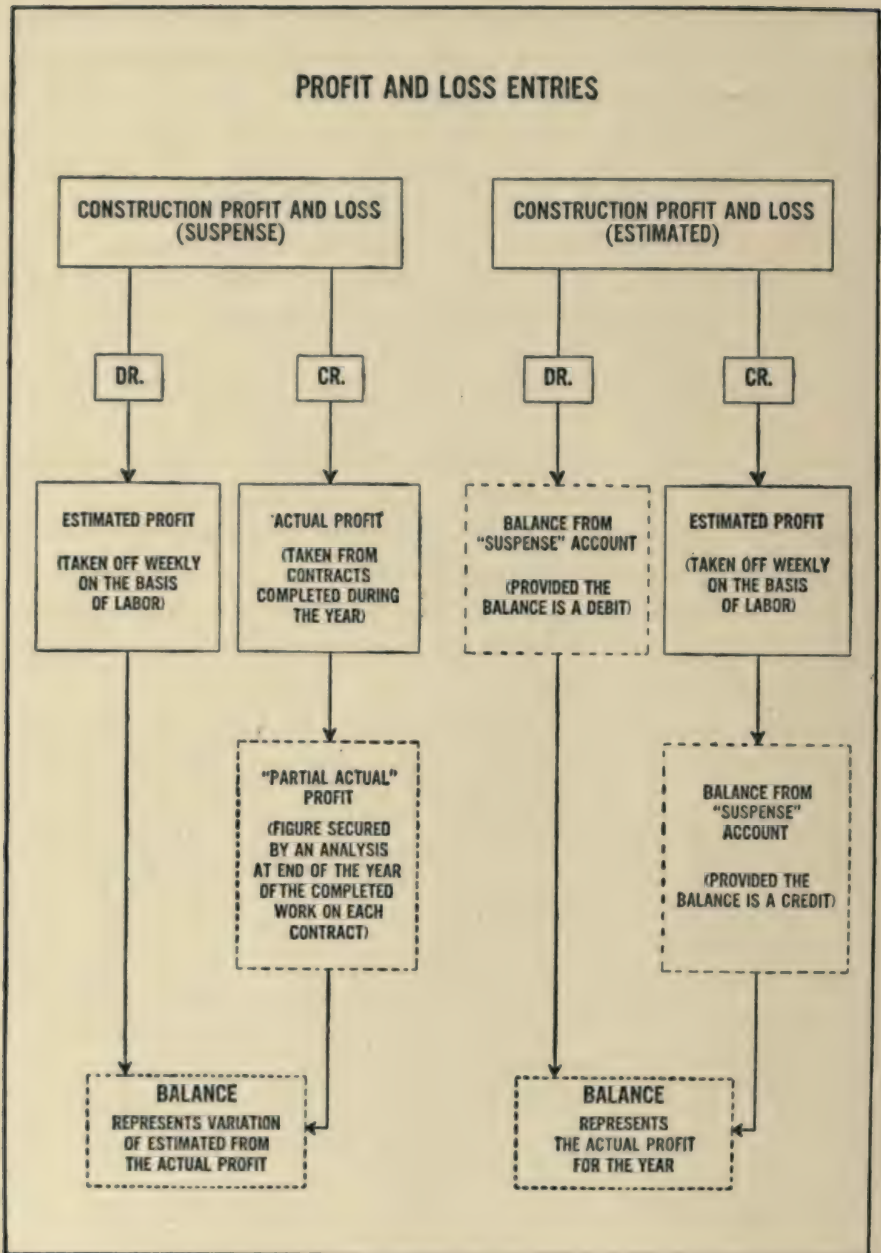


DIAGRAM VII

*This is an analysis of some phases of Mr. Harris's interesting and successful plans for making costs and bids agree, which he describes in detail in chapter XIII.*



weekly or monthly, appears the conservative estimate of the percentage of profit earned on the contracts—a fact made possible by knowing the earning power of labor.

Estimated profit, as it is taken off, is charged to the suspense account. Actual profit on contracts as they are finished is credited to that account. The difference is the amount of estimated profit outstanding on contracts still under way, and is the amount to be added to the investment on contracts under construction in order to obtain the equity thereon.

THE VALUE OF A COMPARISON OF ESTIMATED WITH ACTUAL PROFITS  
ON FINISHED CONTRACTS

Actual profit on the finished contracts should average around twenty-five per cent; while the estimated profit is taken at twenty-two per cent. The difference of about three per cent is the conservative margin that allows for possible emergencies. Since my estimated profit was below the "averaging" point of the actual, the equity is understated this same slight amount.

At the end of the year a careful, individual analysis is made of the contracts under construction at that time, and the actual profit is taken on each on the branches of the contracts that are finished. This "partial actual" profit is also credited to the suspense profit, and added to the actual already taken off on contracts finished, making a total actual profit during the year on completed work.

The "actual" or credit side of the account at the end of the year should be greater by the difference of the conservative margin than the estimated or debit side, providing the contracts are realizing the profit figured. If the estimated percentage is more than the contracts are netting, then the difference will be on the debit side.

The difference, debit or credit, or the variation of the profit for the year from the estimated, is now transferred to "construction profit and loss, estimated," bringing that account to the actual figure.

My method does not hide the actual profit made on contracts nor does it cover up in any way the condition of the business. On the contrary, it assists in stabilizing a "wobbly" business, and proves indispensable in financial statements.

With the profit disposed of, we can now consider the equity. As I have pointed out, this consists of the investment plus the profit earned, and less the amount billed. The detail indicating how this is worked out is shown in Form 50.

PITFALLS TO LOOK OUT FOR WHEN  
DETERMINING THE EQUITY

This appears to be a simple matter to determine each month, but when contracts are completed, the profits taken off and the accounts balanced, the investment is decreased accordingly. Unless some arrangements are made to take care of this decrease, the statement of equity is incorrect. Here is another knot to untangle. Either one of the two methods described below may be used, but I prefer a combination of both, in which less time is consumed and results are sufficiently accurate to make it the most desirable.

The first method is to have the bookkeeper, instead of taking off the "balances," as is usual, list, on each contract in force, the following four items\*:

- Debit (investment)
- Credit (amount billed)
- Contract value
- Partial actual profit taken previously

If the contracts are numerous, the work required when this method is used often takes so much time that the report is delayed several days, and the expense is not justifiable. Some shorter cut must be devised.

The second method is to carry, on the "construction controlling account" in the general ledger, an analysis fly sheet with

\* I credit all returned material, and so on, to the investment on the construction ledger accounts by entering it in red ink and deducting it from the debit, rather than entering it in the credit and spoiling the information given in both columns. The same is done in connection with the amount billed. This keeps the debit and credit "net" and they are thus purely "investments," and "amounts billed," respectively.



columns for the detail. The totals are entered in the same way as in the first method, at the commencement of the year; and the additional investment, bills rendered, and so on, are added as posted, while the details of the contracts as they draw to a close are subtracted. The analysis columns are thus "running totals" of the contracts in force.

The method I prefer follows. The method I have just described may be pursued throughout the year, but it is checked every three, four or six months by taking off a new list, as described in the former method. I check every three months and have found it a splendid means for insuring accuracy and speed, and keeping down expense.

Some accountants may criticise the plan of taking profit on work under way. It has been contended that this profit should rest until the work is completed, in order to be accurate. If, however, a business is consistent and the profits are governed accordingly, there is no reason why they should not be taken periodically. Expenses are accumulating and the comparison of profits with expenses is the only way of knowing where the business stands.

But it is simple to arrive at the amount expended for labor, and also to figure its relation to past work. It is therefore easy to establish the equity and profit on any work in force, within a safe margin. The simplicity, effectiveness and possibilities of the method I use have a strong basis of appeal for the practical man who really wants to know where his business is at. The amount of business completed for any period is obtained from the percentages, and estimates of labor, expenses, or any item on future work may be compiled in the same manner.

I have found my method practical and successful in operation, and extremely valuable in settling the affairs of partners, selling out a business, and at other times when information as to the equity and profits on incompleeted work are required. Thorough records of the sort I keep give me a control of my business that I know no other way of securing.





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